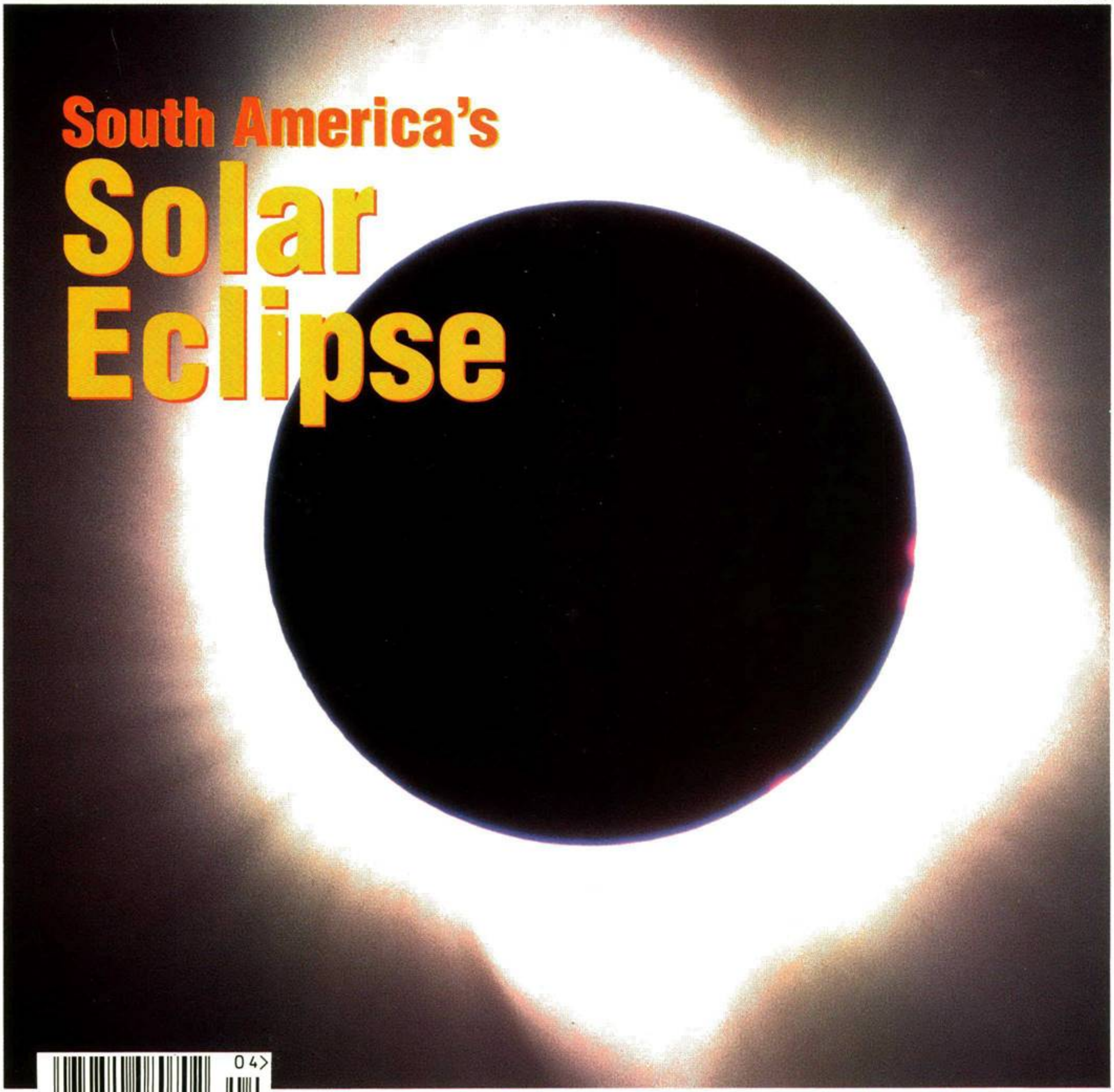
See the Colorful Northern Lights

ASTRONOMY®

April 1995 U.S. $3.50
U.K. £1.95
Can. $4.95

Fire Fountains on the Moon

ICD 08070



South America's Solar Eclipse

- Splendid Spirals for Small Scopes
- Align Your Telescope by Laser

MEADE
12" LX200
10" LX200
8" LX200
MEADE LX200 EMC
MEADE LX200 EMC
MEADE LX200 EMC
Meade

Supplied complete per catalog specifications**:

8" LX200 Schmidt-Cassegrain	**$2495.**
10" LX200 Schmidt-Cassegrain	**$2895.**
12" LX200 Schmidt-Cassegrain	**$3995.**

Packing & shipping in 48 states: 8"—$105; 10"—$145; 12"—$215.

■ **All prices shown are suggested USA mail-order retail prices, exclusive of sales taxes or credit card charges, if applicable.

■ For dealer or catalog information see the **Meade Starfinder Reflecting Telescope** ad in this issue.

LX200

SCHMIDT-CASSEGRAINS

Now with *one arc-minute* pointing accuracy and 64,350-object onboard database as *standard-equipment!*

Meade 8", 10", and 12" LX200 models with standard-equipment High-Precision Pointing™ software now automatically GO TO any input RA and Dec, or to any object in the 64,350-object database, to a pointing precision within one arc-minute!

New Meade Version 3.30 software and high-resolution encoders, used in conjunction with the unique Meade SYNC command, now yield the most precise automatic slewing ever offered in a commercial telescope, an observatory-level of precision and *more than 5 times the precision obtainable with any competing computer-controlled telescope.* Data entry through the telescope's keypad hand controller may be made either from the onboard 64,350-object library database *(see description at right)* or by inputting the desired object's RA and Dec.

Such precise object-acquisition, selectable during either altazimuth or equatorial operation of the LX200, has numerous important implications for the serious observer:

HIGH PRECISION HP POINTING

LX200's with High-Precision Pointing have the HP logo-plate affixed to the telescope's drive base.

☐ Use the GO TO command to *find and center an object in the field of a 4mm eyepiece.*

☐ With other telescopes, acquiring even bright objects on the chip of a CCD imager is generally a chore at best, searching and slewing by trial-and-error until at last the object is positioned on the chip. The LX200's High-Precision Pointing places *every* object on *every* CCD chip *every* time.

☐ Suppose you wish to CCD-image a supernova in an 18th magnitude galaxy—a galaxy invisible *except* through the process of CCD imaging. With Meade High-Precision Pointing, the galaxy can be placed on the chip of every commercially-available CCD unit.

☐ Photographing or imaging faint objects such as the planet Pluto, or comets and asteroids near the photographic limit of the telescope, and plotting the motion of these objects night-to-night, now becomes practical, since the photograph or image may be taken *without the observer ever having seen the object visually,* but knowing that the LX200 will place the object precisely in the telescopic field.

All Meade LX200 models now include a 64,350-object onboard database as standard equipment.

Imagine having 64,350 celestial objects at the tip of your finger: 64,350 objects that you can actuate and center in the telescopic field just by entering and pressing GO TO on the hand controller. **More than 6 times the size of object libraries included with competing telescopes,** the Meade 64,350-object library includes an incredible array of phenomena—virtually a lifetime of deep-space study, even for the advanced observer:

12,921	galaxies from the Uppsala General Catalog; the complete UGC catalog.
7,840	objects from the New General Catalog; the complete NGC catalog.
5,386	objects from the Index Catalog; the complete IC catalog.
21,815	variable stars; the complete listing from the General Catalog of Variable Stars.
15,928	stars from the Smithsonian Astrophysical Observatory (SAO) catalog of stars brighter than 7th magnitude.
351	alignment stars for the LX200 telescope.
110	Messier objects; the complete listing.
8	major planets from Mercury to Pluto.
64,359	objects, total

SPECIFICATIONS: 8", 10", and 12" LX200's—Each complete telescope includes 8" or 10" (f/6.3 or f/10) or 12" f/10 Schmidt-Cassegrain optical tube assembly with EMC super multi-coatings; heavy-duty fork mount with 4" polar ball bearing, dual-axis 5.75" worm gears, and multi-function control panel display on the drive base; manual and electric slow-motion controls on both axes; keypad handheld controller with digital readout display, permanently programmable Smart Drive™, 9-speed drive controls on both axes (7-speed on 12"), High-Precision Pointing, and GO TO controller; 64,350-object onboard celestial software library; 25 ft. power cord and adapter for telescope operation from 115v.AC (for field operation from any 12v. auto cigarette lighter plug, use the Meade #1812 Electronic DC Adapter, a 4-oz. unit available optionally); 8 x 50mm viewfinder with crosshairs; 1.25" diagonal prism (8", 10") or 2" diagonal mirror with 1.25" adapter (12"); Series 4000 Super Plössl 26mm eyepiece; standard field tripod (8", 10") or giant field tripod (12"); foam-fitted carrying case; complete operating instructions.

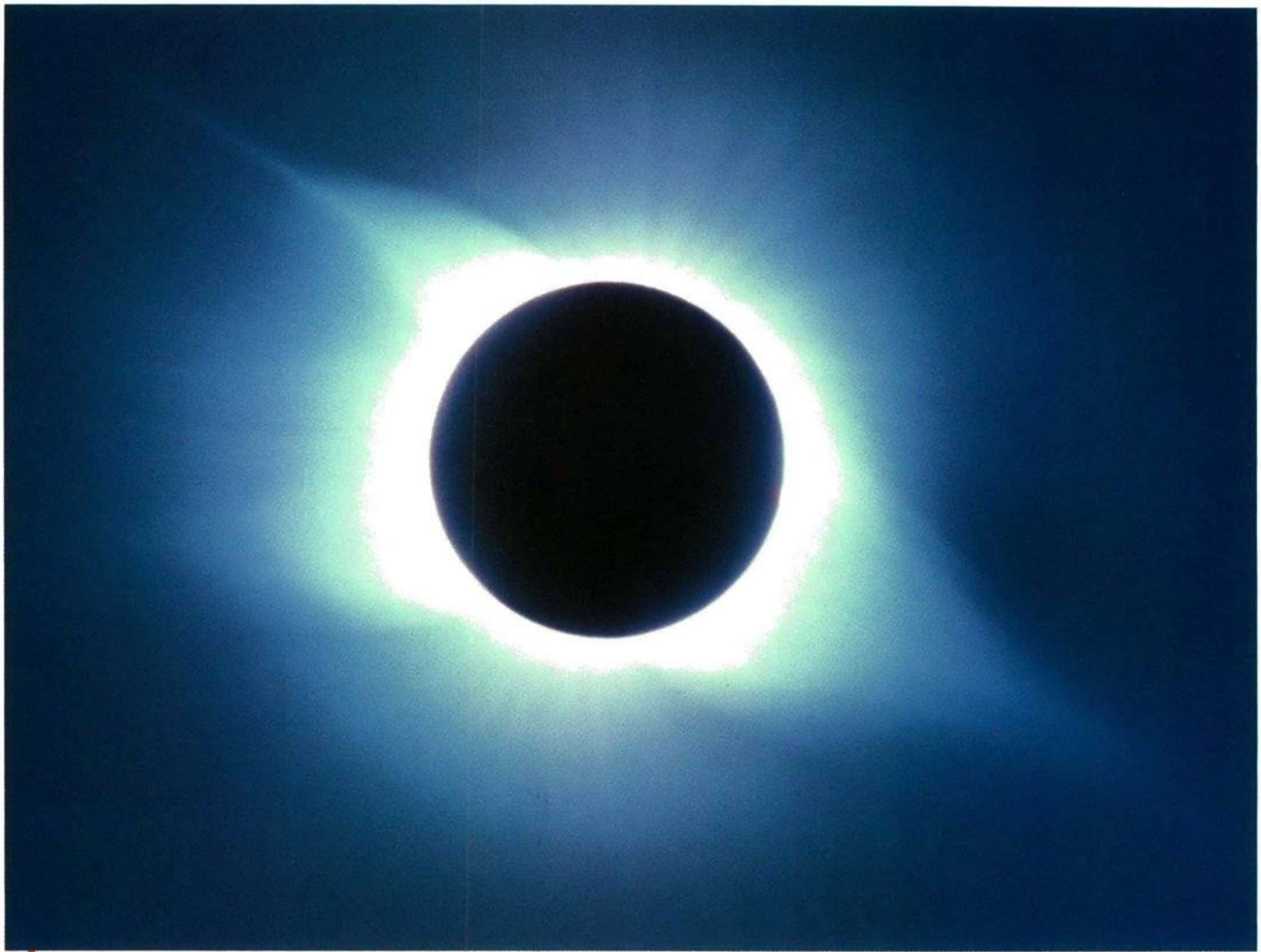
ADVANCED PRODUCTS DIVISION

Meade Instruments Corporation

World's Leading Manufacturer of Astronomical Telescopes for the Serious Amateur
16542 Millikan Avenue, Irvine, Calif. 92714 ☐ (714) 756-2291
FAX: (714) 756-1450

© 1994

ASTRONOMY®
April 1995
Vol. 23, No. 4



Huguette Guertin

66 South America's Solar Eclipse

ON THE COVER

DELICATE BRUSHSTROKES and long streamers painted the Sun's corona during November's spectacular total eclipse. For more stunning photos of the eclipsed Sun, see page 66. Photo by Hal Jandorf.

34 Fire Fountains of Aristarchus
Geysers of volcanic fury dwarfing any on Earth spawned rivers of molten lava that carved the Moon's Aristarchus Plateau. By Graham Ryder and Cassandra Coombs.

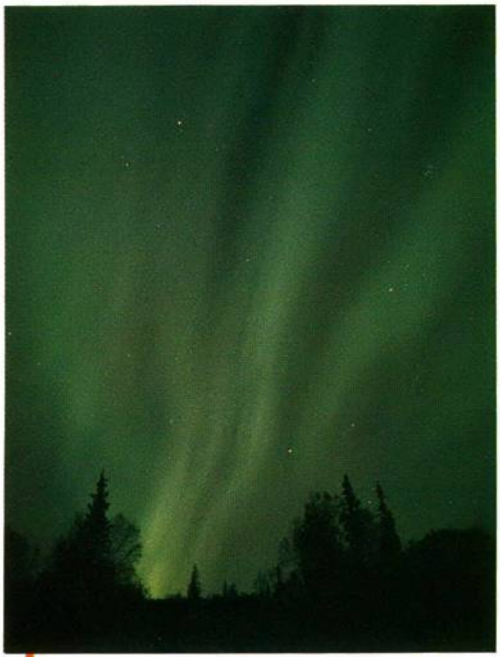
44 Galaxy Time Machine
Looking far into the past, Hubble finds elliptical galaxies looking just like they do today but the forerunners of spirals appearing oddly distorted or fragmented. By David J. Eicher.

48 Only Six with Rings
Astronomers remain perplexed by these odd-looking galaxies with rings circling their poles. By Sally Stephens.

56 Sky Almanac
Saturn returns to the morning sky in April, but the real highlights are eclipses of the Moon and Sun. By Deborah Byrd and Rick Shaffer.

James Hervat

34 Fire Fountains on the Moon


John Flinn

76 See the Northern Lights

Jack Newton

70 Splendid Spirals for Small Scopes

COVER 66

Descent into Darkness

Vivid memories and stunning photos rewarded those who witnessed November's spectacular total solar eclipse. By David J. Eicher.

70

Twelve Splendid Spirals

Even a 6-inch scope can show you striking detail in spring's best spiral galaxies. By Alan Goldstein.

76

Glows, Bands, and Curtains

Intricate shapes and a rainbow of colors highlight the beauty and complexity of the northern lights. By John Shibley.

82

Alignment by Laser Light

Fine-tune the optics of your reflecting telescope with this handy collimating tool. By John Shibley.

DEPARTMENTS

6 Behind the Scenes
- Sun Flower

6 Letters

16 AstroForum
- People of the Sun

22 AstroNews
- Red Dwarfs Can't Explain Dark Matter
- Research Supports Smaller Universe
- A Less Dusty Galaxy?
- X Rays Cast Doubt on Cold Dark Matter
- The Most Distant Galaxy Known
- Americans Get the Mir Experience
- Unexpected Signals from Jupiter
- Moon Reveals New Stars
- An Early Look at the Cosmic Background Radiation

26 Amateur News
- A Party Under Enchanted Skies
- Celebrating Solid Gold Brass

88 New Products
- Soviet Border Binoculars
- Photo Tripod
- Breadboard CCD Camera

92 AstroBytes
- View the Hidden Surface of Venus

95 Astronomy Books
- A Photo Atlas

100 Meetings and Events

104 Resources and Photofacts

106 Advertiser Index

107 Reader Reports
- A Trek to the Southern Sky

112 Ultimate Exposure

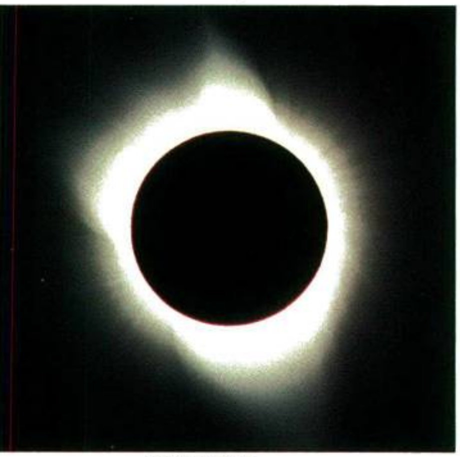
BEHIND THE SCENES

Sun Flower

"What an awesome eclipse!"
"The corona just exploded into view."
"It got so dark I couldn't read the settings on my camera — and wasted time looking for my flashlight!"
"The diamond rings seemed to last forever."
"It was the most beautiful eclipse I've ever seen!"
"Arrrgh! I forgot to load my film!"

From the Pacific to the Atlantic, right across the spine of the Andes, thousands of astronomy enthusiasts converged on South America last November, bent on taking part in one of nature's greatest spectacles. I say "taking part" because as veteran eclipse-chasers know, you don't simply witness or view an eclipse. The whole experience is much too overwhelming for that.

Total eclipse from Bolivia



Dan Schechter

First, there's the sheer scale. "From our vantage point we saw the Moon's shadow racing toward us at hundreds of miles an hour," reported one participant. For many onlookers, the last stages before totality feel like someone is turning off the sunlight with a huge dimmer knob. That alone gives an eerie sense of being a pawn in the hands of the universe.

Then there are the diamond rings — just before and just after totality, showing bits of uneclipsed Sun streaming through the valleys on the limb of the Moon. Last November, the diamond-ring phases seemed to last unusually long and were especially brilliant.

Finally, there's the spectacle of totality itself, centered on the Sun's corona. Nearly everyone who wrote us about the South American eclipse commented on the corona's beautiful shape and detail. The Sun is now relatively inactive in its 11-year cycle, so the corona stuck out behind the Moon like glowing wings. Short streamers reached from the poles and longer streamers extended from the solar equator in a scene unforgettably vivid to the eye.

So what is it about a total solar eclipse?

As the old saying has it, you just have to be there. . .

Sincerely,

Robert Burnham

Robert Burnham
Editor

LETTERS

The New ASTRONOMY

Right on. The heavier paper and back-to-back printing make the Sky Dome map and Path of the Planets ecliptic chart more handy. It works beautifully under dim light. Kudos on moving Reader Reports to the back. Reader Reports is always first on my list with every new issue. Good job! Keep looking to the heavens. — *Russell Goo, Mililani, Hawaii*

NASA's Lack of Focus

The opinions of Eric Chaisson in his article "NASA's Needed Vision" (January 1995) are out of date, incorrect, and totally unsubstantiated. I recently retired from twenty-five years in NASA management where I could observe the headline-producing facet of the agency from within. I've experienced the "old" NASA that excited the nation before struggling to maintain the excitement as the budgets dried up. I chose to leave the "new" NASA because the change means there's no room for leadership of the past. I have not benefited from the new NASA, but I can't agree with Chaisson's views.

His main point seems to be that the new NASA hypes everything it does, lowballs cost estimates to please Congress, and fails to deliver on its promises. From my view, the old NASA could certainly be faulted for this, but not the new NASA. Ask any NASA employee. The agency is so different today than it was two years ago and continues to change dramatically. The agency is now redefining itself internally, to the public, and to Congress.

Chaisson further believes NASA needs a vision. The changes brought forth in the last two years directly result from NASA's new vision. Dan Goldin has turned the agency upside down to save it for the American people. — *Jim Hart, president, Pickering Anomalies, Belmont, California*

ASTRONOMY®

Robert Burnham Editor
Rhoda Sherwood Managing Editor
David J. Eicher Associate Editor
David H. Bruning Associate Editor
John Shibley Associate Editor
Richard Talcott Assistant Editor
Tracy Staedter Editorial Assistant
Julie Sherwin Editorial Secretary

Thomas L. Hunt Art Director
Gary Kachar Graphic Designer

U.S. and International Newsstand Distribution
I.C.D., The Hearst Corp., New York, NY 10019

Walter J. Mundschau President
Russell G. Larson Publisher
James John Marsala Corporate Art Director

Daniel R. Lance Vice President, Sales & Marketing
Kimberly A. Bennett Advertising Sales Manager
Debbi A. Simon Advertising Sales Representative
Mary Reynolds Advertising Services Representative
Colby Waller Blue Sky Pages Representative
Advertising Department (800) 558-1544

Canadian Newsstand Distribution
Telemedia Dist., Toronto, Ontario M4S 3B3

ASTRONOMY is published monthly by Kalmbach Publishing Co., 21027 Crossroads Circle, P.O. Box 1612, Waukesha, WI 53187. Editorial phone: (414) 796-8776; advertising: (800) 558-1544; customer service: (800) 446-5489; subscriptions: (800) 533-6644 7 days a week, 24 hours a day; fax (414) 796-0126.

Copyright © 1995 Kalmbach Publishing Co., all rights reserved. Material in this publication may not be reproduced in any form without permission.

Second-class postage paid at Waukesha, WI, and additional mailing offices. Allow 6 to 8 weeks for new subscriptions and address changes. Subscription price: 1 year $27. Canadian and foreign: 1 year $38, GST (#R122713209) included; please remit in U.S. funds. Not responsible for unsolicited materials. POSTMASTER: Send address changes to Astronomy, 21027 Crossroads Circle, P.O. Box 1612, Waukesha, WI 53187. Canadian second-class postal permit no. 545775. Printed in the U.S.A.

The Audit Bureau

MEADE

EYEPIECES AND ACCESSORIES

Series 4000™ Super Plössls

Meade 4-element Super Plössls, updated and redesigned to utilize the latest in optical glass-types for 1994, are the finest general-purpose eyepieces available. For observing hairline lunar and planetary detail, splitting close doubles, or for deep-space; guaranteed to deliver more contrast and image sharpness than any other brand. Rubber eyeguards fold down for eyeglass wearers–a feature not available on competing brands. Multi-coated. All focal lengths through 32mm are parfocal.

Super Plössls (SP; 4-elements; 1.25"; 52°):

6.4, 9.7, 12.4, 15, 20, 26mm each:	**$87.95**	(3.45)
32mm (52°); **40mm** (44°) each:	**109.95**	(3.79)
56mm (52°; 2")	**229.95**	(5.48)

Series 4000™ f/6.3 Focal Reducer/ Field Flattener

Manufactured to exclusive Meade optical designs; threads on to any Meade or Celestron Schmidt-Cassegrain rear cell and converts f/10 scopes to f/6.3 (or f/6.3 SCT's to f/4), while significantly flattening the field. Use with SCT visual or photo accessories. Actual visual field is increased by 56%, for fine wide-field views of star fields and nebulae. In astrophotography, reduces exposure times by about 50%, while producing an actual field diameter of 1.5° at the film plane. A tremendous aid with CCD imagers in reducing image size for locating and centering images on CCD chips. 4-element optics; multi-coated; 41mm clear aperture.

$129.95 (3.60)

Series 4000™ Super Wide Angle

For exquisite wide-angle images at low-to-medium powers, ideal for star fields, galaxies, and other deep-space phenomena. SWA 13.8, 18, and 24.5mm are superb complements to the #140 Barlow.

Super Wide Angle (SWA; 6-elements; 1.25"; 67°)–**13.8mm: $159.95** (3.49); **18mm: 169.95** (3.69); **24.5mm: 199.95** (3.89); **32mm** (2"): **279.95** (4.78); **40mm** (2"): **339.95** (5.48)

Series 4000™ Ultra Wide Angle

The ultimate eyepieces; extreme image sharpness over an amazing 84° field.

Ultra Wide Angle (UWA; 8-elements; 1.25"; 84°)–**4.7mm: $179.95** (3.29); **6.7mm: 219.95** (3.29); **8.8mm** (1.25"/2"): **269.95** (4.78); **14mm** (1.25"/2"): **329.95** (5.48)

Series 4000™ #140 2x Apochromatic Barlow Lens

The most advanced Barlow Lens available for commercial telescopes; includes 3-element, air-spaced optics, multi-coated. Unmatched in image resolution, contrast and color correction. Accepts 1.25" eyepieces. Lens dia. 28mm; clear aperture 26mm.

$79.95 (3.29)

SALE!

Series 3000 Plössls Save up to 30%!

Now you can buy Meade *multi-coated* Series 3000 Plössl Eyepieces—the finest moderately-priced eyepieces ever manufactured—at never-before prices!

See complete eyepiece description elsewhere on this page.

Buy one or buy a dozen!
No minimum, no maximum!

Series 3000 Plössl 5, 6.7, 9.5, 16, or 25mm:

each **$39.95** (3.45)

(regularly $46.95 to $57.95)

Series 3000 Plössl 40mm:

each **$69.95** (3.79)

(regularly $79.95)

This special offer is valid between November 20, 1994 and March 31, 1995, at participating Meade dealers in the U.S.A. and is subject to eyepiece availability.

Series 3000™ Plössls

The very latest in eyepieces from Meade optical designers, new Meade Series 3000 Plössls yield the finest image corrections obtainable from the classical 4-element Plössl design. Available in a wide range of focal lengths from 5mm through 25mm. All five eyepieces are parfocal, so that, at most, only slight refocusing of the image is necessary from eyepiece to eyepiece. Unlike competing moderately-priced Plössls, Meade Series 3000's are **multi-coated** for maximum light transmission and image contrast. Chrome-plated brass barrels are threaded for standard filters. Manufactured exclusively for Meade Instruments by one of Japan's leading lensmakers, Series 3000 Plössls produce excellent results on reflectors, refractors, and Schmidt-Cassegrains of any focal ratio.

Series 3000 Plössls (4-elements; 1.25"; 50°)

5, 6.7, 9.5, 16, 25mm each: **$57.95** (3.45) **Any 2: $52.95** each; **Any 3: $48.95** each; **Any 4 or 5: $46.95** each.

Series 3000™ Plössl 40mm

A perfect complement to the Series 3000 Plössls at left, this all-new Plössl 40mm produces spectacular low-power, wide-field results with any telescope. Includes classical 4-element Plössl optics, multi-coated. Barrel dia. 1.25"; threaded for filters. Apparent field: 44°.

$79.95 (3.79)

Series 4000 Photo-Visual Color Filters (1.25")—Made of purest crown optical glass, dyed in the mass. For increased contrast and resolution on the Moon and planets. Thread into the barrels of virtually all 1.25" eyepieces sold today. Fully coated.

#8 Lt. Yellow; #11 Yellow Green; #12 Yellow; #21 Orange; #23A Lt. Red; #25A Red; #38A Dark Blue; #47 Violet; #56 Lt. Green; #58 Green; #80A Blue; #82A Lt. Blue

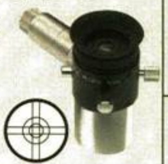
each	**$14.95**	(2.29)
Moon Filter #ND96–Reduces brightness by 87%.	**16.95**	(2.29)
Set #1–4 filters: #12, #23A, #58, #80A	**54.95**	(2.98)
Set #2–4 filters: #11, #25A, #47, #82A	**54.95**	(2.98)
Set #3–4 filters: #8, #21, #38A, #56	**54.95**	(2.98)
Sets #1 & #2–8 filters	**99.95**	(3.45)
Sets #1, #2, & #3–12 filters	**144.95**	(3.79)

#911B
#910B
#908B
#911N
#910N
#908N

Series 4000 Nebular Filters—Premium multi-layer interference filters, the finest obtainable. Use broadband ("B") filters to block most forms of light pollution; use narrowband ("N") filters in heavily light-polluted areas or for extremely high-contrast observing of faint nebulae.

#908B–Threads into 1.25" eyepieces, 26mm dia.	**79.95**	(2.98)
#910B–Threads into 2" eyepieces, 44mm dia.	**119.95**	(3.29)
#911B–Threads on to rear cell of Schmidt-Cassegrain telescopes. 36mm dia.	**99.95**	(3.29)
#908N–Threads into 1.25" eyepieces, 26mm dia.	**89.95**	(2.98)
#910N–Threads into 2" eyepieces, 44mm dia.	**129.95**	(3.29)
#911N–Threads on to rear cell of Schmidt-Cassegrain telescopes. 36mm dia.	**119.95**	(3.29)

World's Most Advanced Illuminated Reticle Eyepiece



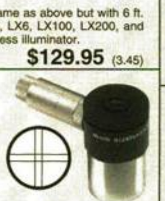
Series 4000 Plössl 9mm, with rubber eyecup and micrometric X-Y positioning of the reticle within the field. Greatly facilitates locking on the guide star. Sharp high-power imaging, excellent eye relief. Wireless red LED illuminator with adjustable brightness control. **Internal batteries included.** Multi-coated optics. Bullseye reticle. 1.25"

$149.95 (3.45)

Series 4000 Plössl 9mm—Same as above but with 6 ft. cord and plug for Meade LX3, LX5, LX6, LX100, LX200, and APO power panels, in place of wireless illuminator.

$129.95 (3.45)

MA 12mm Illuminated Reticle Eyepiece



Excellent 3-element optical system, long eye relief, fully coated, with double crossline reticle. Wireless red LED illuminator and variable brightness control. **Batteries included.**

$99.95 (3.45)

MA 12mm—Same as above but with cord and plug for Meade telescopes with power panels, in place of wireless illuminator.

$79.95 (3.45)

2" Diagonal Mirror

#929: Permits use of wide-field 2" oculars. Threads on to rear cell of Meade and Celestron SCT's. Includes multi-coated precision optical flat made at the Meade factory; with 1.25" eyepiece adapter. **$99.95** (3.79)

Camera Adapters (1.25" & .965")

Professional-quality adapters for rigid coupling of telescope-to-camera. Use for either Eyepiece-Projection or Prime Focus. Precision-machined of aluminum and brass, threaded for filters. Use with T-mount, available separately.

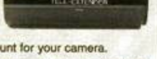
.965": $27.95 (2.98) **1.25": $29.95** (2.98)

Variable-Projection Camera Adapter (1.25")

Machined sliding cell allows variable projection power in eyepiece-projection photography; permits precise selection of correct photo power in lunar and planetary photography; threaded for filters. Use with T-mount for your camera.

$39.95 (2.98)

Tele-Extenders



For Eyepiece-Projection photography with any Meade or Celestron SCT. Threads on to any eyepiece-holder. Use with T-mount for your camera.

Basic Tele-Extender: *(above)* Fixed projection power; use with eyepiece for lunar and planetary photos.

$29.95 (2.98)

Variable Tele-Extender: Sliding cell, with lock, permits wide range of projection magnifications with the same eyepiece.

$39.95 (2.98)

T-Adapters for SCT's

For Prime Focus photography with any Meade or Celestron SCT. Use with T-Mount for your 35mm camera.

$26.95 (2.98)

2x Telenegative Barlow (1.25")

#122: Doubles eyepiece power with sharp, high-resolution, high-contrast imaging on telescopes of all types. 27mm dia. (26mm clear aperture). Excellent corrections for chromatic and spherical aberrations at all photo-visual wavelengths. Multi-coated. 1.25"

$47.95 (3.45)

2x-3x Variable Barlow (1.25")

#127: Precision internal sliding lens assembly permits continuously variable power settings between 2x and 3x. Engraved scale indicates power in use. Yields bright, sharp, high-contrast images on telescopes of all types. Multi-coated; 1.25"

$59.95 (3.45)

2x Short-Focus Barlow (1.25")

#126: Only 2.5" long, the #126 works well with any telescope accepting 1.25" eyepieces, even those with limited focus range. Maintains the high image quality of the #122, above. Insert the #126 into star diagonal for 2x or insert star diagonal into #126 for 3x. 26mm clear aperture. Multi-coated.

$47.95 (3.45)

Modified Achromatic Eyepieces

An improvement on the traditional Kellner design, these 3-element Modified Achromatic eyepieces give sharp, faithful, well-corrected images of the moon, planets, and deep-space at an economical price. Multi-coated; threaded for filters; 1.25" barrel diameter. Apparent field: 40°. **MA 9, 12, 25, 40mm.**

each: **$37.95** (2.98)

HOW TO ORDER

- Prices shown are suggested USA mail-order retail prices and do not include any applicable sales taxes.
- Suggested shipping and handling charges to the 48 states by UPS or US Mail shown in ( ) next to each price.
- Meade accessories may be ordered from any Meade Advanced Products Dealer. **The following national mail-order dealers carry all Meade accessories in-stock for immediate shipment:**

ASTRONOMICS, Norman, OK.
Orders: 800-422-7876; Info.: 405-364-0858.

CALIFORNIA TELESCOPE CO., Burbank, CA.
Orders: 800-843-4780; Info.: 818-505-8424.

CITY CAMERA, Dearborn, MI.
Orders: 800-359-5085; Info.: 313-846-3922.

FOCUS CAMERA, Brooklyn, NY.
Orders: 800-221-0828; Info.: 718-436-6262.

LUMICON, Livermore, CA.
Orders: 800-767-9576; Info.: 510-447-9570.

SHUTAN CAMERA & VIDEO, Chicago, IL.
Orders: 800-621-2248; Info/IL: 312-332-2000.

Canada:
KHAN SCOPE CENTRE, Toronto, Ontario.
Orders & Information: 416-783-4140.

© 1995

STARFINDER™ DOBSONIANS

Now you can buy a Dobsonian telescope with quality Meade® optics and components—at a fraction of the price you'd expect to pay.

And receive a $125 Accessory Package for only $49.95!

10" f/4.5
$595.

12.5" f/4.8
$795.

8" f/6
$425.

Shown with optional #637 6 x 30mm or #545 8 x 50mm Viewfinders

6" f/8
$325.

MEADE
STARFINDER
MEADE

SPECIAL ACCESSORY OFFER!

At the time you order any Starfinder 6", 8", 10", 12.5", or 16" Dobsonian Telescope, you can buy **two additional Meade multi-coated Modified Achromatic MA9mm and 12mm eyepieces** ***and*** **the Meade #637 6 x 30mm coated achromatic viewfinder with metal bracket for a *total* of only $49.95! Purchased separately, the 2 additional eyepieces and viewfinder sell for $125.85!** *(Shown in photo: MA9mm, MA12mm, and standard-equipment MA25mm eyepieces, with #637 6 x 30mm viewfinder.)* Offer valid until further notice.

Starfinder Dobsonian 16

16" f/4.5
$1195.

MEADE
STARFINDER
MEADE

See the Meade General Catalog for details.

Includes giant #682 focuser; shown with optional 8 x 50mm viewfinder.

Compare Meade Starfinders *feature-for-feature* with other similarly priced Dobsonians!

- **Primary and Secondary Mirrors of Low-Expansion Pyrex® glass!** Unlike the plate-glass optics of other Dobsonians that can become thermally unstable (especially in larger apertures), Meade Dobsonians include the *exact same* professional-quality Grade-A, fine-annealed Pyrex® optical systems used on Meade Starfinder Equatorial Reflectors. Optics that meet the theoretical limits of resolution for their apertures.
- **Precision Rack-and-Pinion Focuser!** An industry-standard full-size rack-and-pinion system with 2.6" of focus travel.
- **Fully-Adjustable 4-vane Secondary Mirror Systems!** *Rigid 4-vane systems* that permit precision alignment of the secondary mirror to the primary mirror.
- **Rigid, Durable, Beautiful Dobsonian Mountings!** Mountings that provide extremely smooth motions of the telescope in both altitude and azimuth. Both telescope axes ride on zero-backlash Teflon/Nylon bearings, facilitating the location and tracking of celestial objects anywhere in the sky. Each mount is manufactured of cabinet-quality materials and designed for a lifetime of use. Handles are provided for easy portability.
- **Optical Tubes:** Starfinder Dobsonians include the same strong, spiral-wound optical tubes used on Starfinder Equatorials *(facing page)*. All telescopes include a multi-coated MA25mm eyepiece as standard equipment. Each tube is factory pre-drilled for the optional 6 x 30mm or 8 x 50mm viewfinder.
- **Performance!** A Meade Starfinder Dobsonian or Equatorial Telescope opens up the skies to an extremely wide range of serious visual observing: all 110 Messier objects, thousands of NGC objects–nebulae, galaxies, star clusters, in all their variations of form, color, and extent, as well as the Moon and planets in stunning, high-resolution detail. Starfinder Dobsonians are telescopes for visual observing; motor-driven Starfinder Equatorials may be used, in addition, for lunar and planetary photography and even for limited deep-space astrophotography.
- **Packing and UPS Shipping Charges:** to any address in the 48 states: 6"–$39; 8"–$49; 10"–$69; 12.5"–$79. 16"–$45 packing, shipped truck freight collect.
- **To Order:** Contact one of the authorized mail-order dealers on the facing page.

MEADE

STARFINDER™ EQUATORIALS

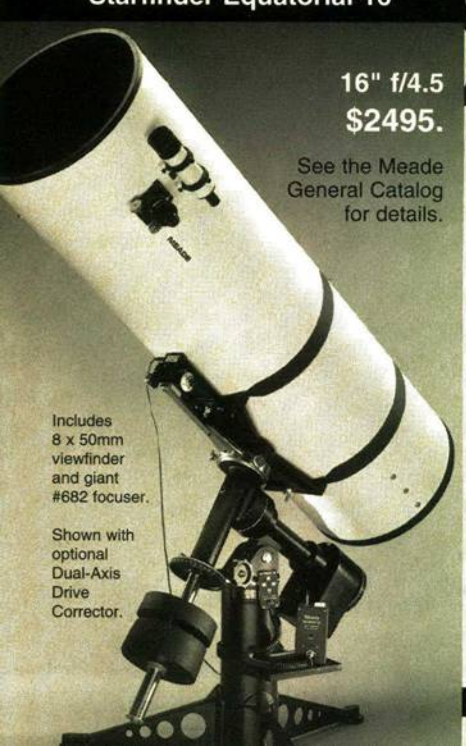
Complete **6", 8", and 10" telescopes with equatorial mounts, motor drives, setting circles, and full accessorization... from $599.95!**

6" f/8
$599.95

8" f/6
$699.95

10" f/4.5
$799.95

Starfinder Equatorial 16


16" f/4.5
$2495.

See the Meade General Catalog for details.

Includes 8 x 50mm viewfinder and giant #682 focuser.

Shown with optional Dual-Axis Drive Corrector.

Standard equipment on 6", 8", and 10" models includes:

- **Superb Optical System:** Includes hand-figured parabolic primary mirror that meets the theoretical limit of resolution for its aperture, with matching elliptical flat secondary mirror. Both mirrors multi-coated and made of low-expansion, Grade A, fine-annealed Pyrex® glass.
- **Precision Equatorial Mount:** Manufactured of machined aluminum to tolerances of .001" or better, with 4"-dia. pier and die-cast tripod legs, for rock-solid support of the optical tube. The telescope moves effortlessly from object-to-object on precision bearing surfaces. Polar and declination shafts are 1" solid steel. Setting circles on both axes facilitate the location of faint objects directly from their catalogued coordinates.
- **Electric Motor Drive** (115v/60Hz) with 6 ft power cord: permits **fully automatic** tracking of celestial objects; plugs into any standard outlet.
- **Standard Accessories and Components:** Precision Rack-and-Pinion Focuser (1.25") with full 2.6" travel; coated achromatic #637 6 x 30mm Viewfinder with crosshair eyepiece and 7° field; multi-coated MA25mm (1.25") eyepiece, threaded for filters; strong, durable, spiral-wound optical tube with attractive white finish.
- **Optional Accessories:** See the Meade accessories ad in this issue. Additional systems, including #55 Manual Declination Control, #43 Drive Corrector, and #47M Dual-Axis Drive Corrector, are described in the Meade General Catalog.

SPECIAL ACCESSORY OFFER! At the time you order any Starfinder 6", 8", 10", or 16" Equatorial Telescope, you can buy **two additional Meade multi-coated Modified Achromatic MA9mm and 12mm eyepieces for a *total* of $29.95! Purchased separately, the two additional eyepieces sell for $75.90.** *(Shown in photo: MA9mm, MA12mm, and standard-equipment MA25mm eyepieces.)* Offer valid until further notice.

- **Packing and UPS Shipping Charges:** to any address in the 48 states: 6"–$65; 8"–$75; 10"–$90. 16"–$55 packing, shipped truck freight collect.
- All prices shown are suggested USA mail-order retail prices, not including any applicable sales taxes.
- **Meade 1995 General Catalog** — $3.00 postpaid—is available from any authorized Meade dealer or directly from Meade Instruments.
- For further information call Meade Instruments at 714-756-2291 or contact one of these authorized mail-order dealers:

ASTRONOMICS, Norman, OK.
Orders: 800-422-7876; Info.: 405-364-0858.

CALIFORNIA TELESCOPE COMPANY, Burbank, CA.
Orders: 800-843-4780; Info.: 818-505-8424.

CITY CAMERA, Dearborn, MI.
Orders: 800-359-5085; Info.: 313-846-3922.

FOCUS CAMERA, Brooklyn, NY.
Orders: 800-221-0828; Info.: 718-436-6262.

LUMICON, Livermore, CA.
Orders: 800-767-9576; Info.: 510-447-9570.

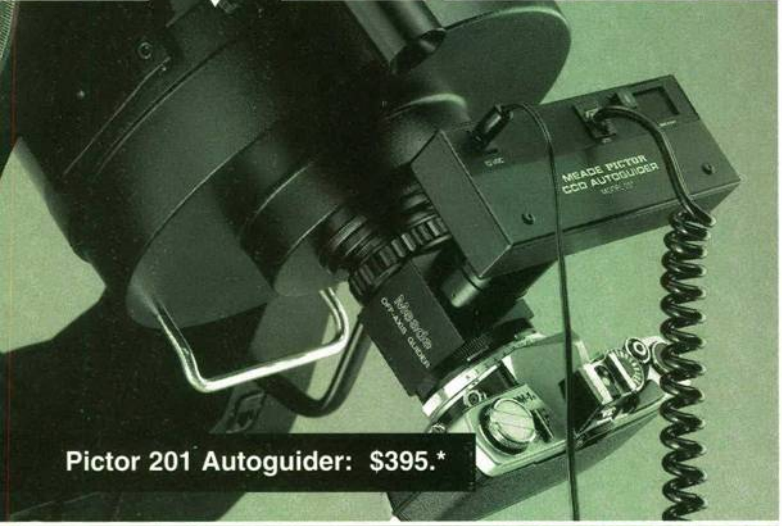
SHUTAN CAMERA & VIDEO, Chicago, IL.
Orders: 800-621-2248; Illinois & Info.: 312-332-2000.

Canada:
KHAN SCOPE CENTRE, Toronto, Ontario.
Orders & Information: 416-783-4140.

ADVANCED PRODUCTS DIVISION
Meade Instruments Corporation
World's Leading Manufacturer of Astronomical Telescopes for the Serious Amateur
16542 Millikan Avenue, Irvine, Calif. 92714 ☐ (714) 756-2291
FAX: (714) 756-1450

© 1995

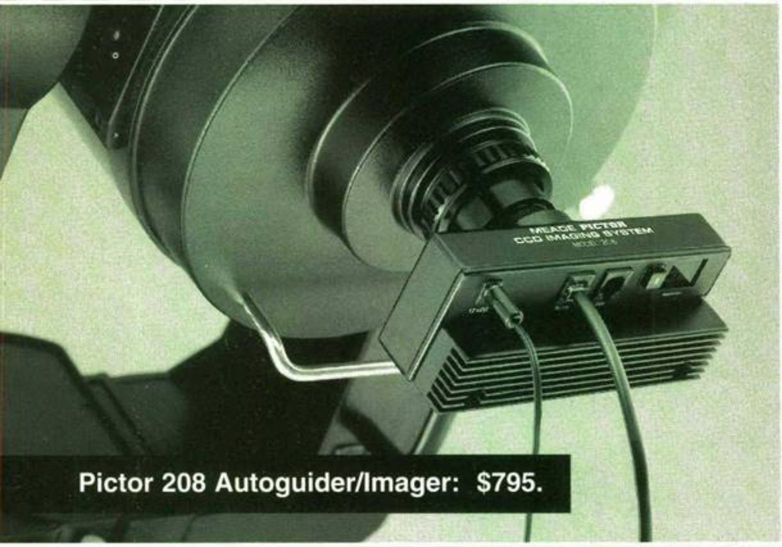
PICTOR™ SERIES CCD AUTOGUIDER/IMAGERS


MEADE PICTOR
CCD AUTOGUIDER
Meade
OFF-AXIS GUIDER

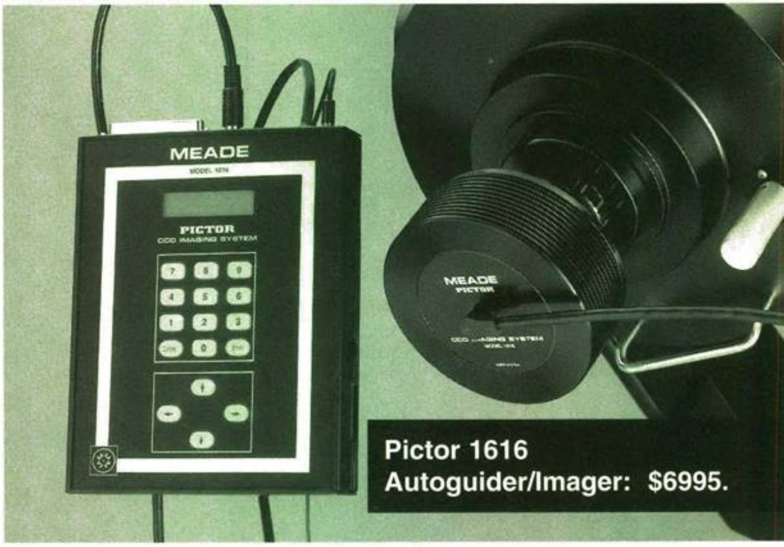
Pictor 201 Autoguider: $395.*

MEADE
MODEL 416
PICTOR
CCD IMAGING SYSTEM
MEADE
PICTOR
CCD IMAGING SYSTEM

Pictor 416 Autoguider/Imager: $2495.


MEADE PICTOR
CCD IMAGING SYSTEM

Pictor 208 Autoguider/Imager: $795.


MEADE
MODEL 1616
PICTOR
CCD IMAGING SYSTEM
MEADE
PICTOR
CCD IMAGING SYSTEM

Pictor 1616 Autoguider/Imager: $6995.

MEADE PICTOR
CCD IMAGING SYSTEM

Pictor 216 Autoguider/Imager: $1195.

For the beginner, or for the most advanced observer, the *real* CCD revolution is here. There's a Meade® CCD system to fit your budget and your imaging requirements.

To obtain your copy of the all-new Meade 76-page 1994-95 General Catalog ($3.00 ppd.), see your authorized Meade Advanced Products Dealer or write directly to Meade Instruments.

*Plus packing and shipping; prices shown are suggested U.S.A. mail-order prices, not including any applicable sales taxes.

ADVANCED PRODUCTS DIVISION
Meade Instruments Corporation
World's Leading Manufacturer of Astronomical Telescopes for the Serious Amateur
16542 Millikan Avenue, Irvine, Calif. 92714
(714) 756-2291 ☐ FAX: (714) 756-1450

© 1994

MEADE
THE LEGEND CONTINUES...
MEADE LX200
MEADE LX200 EMC

16" LX200

Professional instrumentation for the demanding school, college, or university research program—or as the ultimate personal telescope for the advanced amateur.

Professional-grade 16" f/10 optical system meets or exceeds advanced requirements; includes BK7 correcting plate for high UV transmission and EMC super multi-coatings. ■ **Massive one-piece fork mount** permits substantial auxiliary equipment to be piggybacked with rock-solid stability. ■ **Large 11" worm gears** on both axes, with factory-programmed Smart Drive™; periodic error less than 5 arc seconds. ■ **Automatic GO TO capability** to any object in the onboard 64,350-object database or to any input R.A. and Dec. ■ **High-Precision Pointing™** to within one arc-minute in the GO TO mode. ■ **DC servo drive systems** with integrated encoders and planetary gearboxes; encoder resolution: 0.13 arc secs. ■ **Six pushbutton-controlled drive-speed rates,** from photo-guide to fast-slew on both axes, simultaneously. ■ **Micro-processor controlled sidereal-rate tracking** in AZ or EQ modes with quartz accuracy. ■ **Home-Pulse Acquisition** permitting remote alignment and operation through a modem link to the telescope's RS-232 interface. ■ **Control panel connectors** for optional systems including CCD autoguiders and imagers, electric focuser, and the Meade **#1222 Field De-rotater** for long-exposure astrophotography in the AZ mode. ■ Available with **supergiant transportable field tripod** (2-person field set-up in less than 10 minutes); **permanent altazimuth pier** (permitting the entire instrument to be housed in a 2-meter dome); or **permanent equatorial pier** (in cases where piggybacked astrocameras do not permit field de-rotation).

The Meade 16" LX200 is in continuous production at the Meade Irvine, Calif. factory. **Delivery time:** 4 to 12 weeks, depending on order status. **Price:** $14,950, complete with supergiant field tripod, plus $385 packing and shipping in the 48 states; prices slightly higher with permanent altazimuth or equatorial pier.

For your copy of the all-new **1994-95 Meade General Catalog** ($3.00), write Meade Instruments or contact your authorized Meade Advanced Products Dealer.

ADVANCED PRODUCTS DIVISION

Meade Instruments Corporation

World's Leading Manufacturer of Astronomical Telescopes for the Serious Amateur

16542 Millikan Avenue, Irvine, Calif. 92714 □ (714) 756-2291
FAX: (714) 756-1450

© 1994

Celebrate the Oldest Science.

M51
HORSEHEAD NEBULA

1-800-NITE SKY • orders only (VISA/MC) or send in check/mo

Complete Brochure: SASE to:
Main Sequence • P.O. Box 3882
Scottsdale, AZ • 85271

- Tee-100% Heavyweight Pre-shrunk Cotton
- Sweat-Heavyweight 50/50 Blend
- Satisfaction Guaranteed; Prompt delivery

Print your club name on our shirts, or have us create a hat, shirt, bag, etc. especially for your group! We offer group discounts and welcome dealer inquiries.

NEW

M51 Whirlpool Galaxy (White on Black) M-XL Tee 16.95, XXL 17.95. Add 12% S/H.

Horsehead Nebula (Fluorescent Red, Purple, White on Black) M-XL Tee 17.95, XXL 18.95. Sweat L-XL only, $24.95. Add 12% S/H.

3" VIEWFINDER

$49.95 Complete

LIMITED QUANTITIES

add $5 S&H US – diagonal & eyepiece not included

3" f/4.5 Multi-Coated Achromatic Objective

mounted in machined aluminum cell with 1 1/4" helical-lock focusing & extension tube for straight-through viewing. Plans for easy-to-make collimating mounts included. Sound too good to be true? It will be when they're gone! Order early – WHILE SUPPLY LASTS.

1-719-495-3828
CREDIT CARD ORDERS

BLACK FOREST OBSERVATORY
Department AS2
12815 Porcupine Lane
Colorado Springs, CO 80908

IMAGE DOES MAKE A DIFFERENCE.

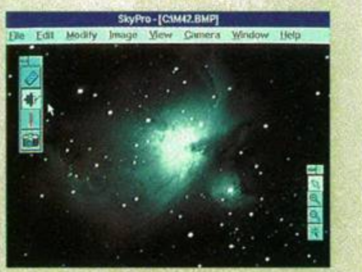
INTRODUCING SKYPRO IMAGE PROCESSING SOFTWARE WITH CCD CAMERA SUPPORT.

In CCD astronomy differences can be startling. So unlock the heavens with SkyPro™ image processing software for Windows and transform your raw, mystery-cloaked images into marvels of clarity and detail.

SkyPro opens a remarkable store of earthbound wonders: multiple-image displays, drag-and-click operation and a host of sophisticated image processing features. When used in concert with TheSky™ Astronomy Software, SkyPro transports you beyond amateur star science, creating a seamless integration between locating, capturing and processing any celestial object.

SkyPro - [C:\M42.BMP]
File Edit Modify Image View Camera Window Help

Unprocessed M42, located and downloaded using TheSky and SkyPro. A 19 second exposure with an 8" Maksutov ...



Processed M42 using SkyPro.

To take things one giant step further, SkyPro and TheSky make *Remote Astronomy* a reality. In fact, their remote technology features are the centerpiece of the Mt. Wilson Project, California's pathbreaking schoolroom-lab experiment.

And here's yet another marvel. At just $199, SkyPro is the most powerful, inexpensive tool you can add to your CCD catalog.

Now, that's some difference.

Also available on CD ROM with unprocessed practice images.

SKYPRO™
CCD Astronomy Software

Toll Free: 800.843.7599 • FAX: 303.278.0045 • Voice: 303.278.4478

Software Bisque
912 Twelfth Street, Suite A
Golden, Colorado 80401

SkyPro and TheSky are registered trademarks of Software Bisque.

LETTERS

Chaisson addressed several important points, but failed to highlight the most important factor that separated the old NASA from the new. Nationalistic competition during the Cold War may not have carried intellectual nobility, but it did help us get the job done. I wish everyone could be convinced that we should pursue knowledge for its own sake. But for now, those who pay for space exploration will ask, "What's in it for us?" And the viewpoint that can provide the best answer is likely to win.
— *Kathleen Blakeslee, Carmel, Indiana*

> **Those who pay for space exploration will ask, "What's in it for us?"**
>
> *Kathleen Blakeslee, Carmel, Indiana*

Not the Whole Cluster

The interesting article by Ron Cowen on "The Debut of Galaxies" (December 1994) included a full-page color reproduction which was meant to illustrate the large-scale clustering of galaxies and which was identified inaccurately in the caption as the Coma Cluster. This image, which was supplied by me, was obtained in March with the Wide Field and Planetary Camera 2 of the Hubble Space Telescope.

Actually, the picture includes only one Coma Cluster galaxy, NGC 4881, the bright object in the upper left corner. It glows at 13th magnitude and is the ninth brightest member of the cluster, which lies an estimated 300 million light-years away. With the exception of two or three foreground Milky Way stars, other objects in the picture are background galaxies, most of them more than ten times farther away than the Coma Cluster.

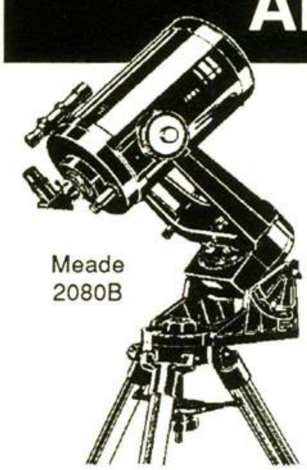
The Hubble Space Telescope camera provides high resolution but covers only a tiny field in the sky. It would require more than a thousand HST images to build a mosaic covering the Coma Cluster. — *William A. Baum, HST WFPC Team, Seattle, Washington*

Dark Lanes Are Real

In October 1994 Letters, Alister Ling noted, obviously revealing some astonishment, "M13 Does Have Dark Lanes!"

Anyone can sell you a telescope.

We'll sell you the right one.



Meade 2080B

Authorized Meade Dealer

Hardly a day goes by that we don't get a note like the one reprinted below, or a call that goes something like this: "Your ads are right. So and so on the East Coast advertises low prices – but they don't have what I want in stock, they couldn't answer *any* of my questions, and they wanted my credit card number before they'd even *talk* to me. They said if I wanted to ask questions, I should call the manufacturer . . . and then they hung up on me!"

It takes more than a camera store clerk with a price list and a bad attitude to help you pick the right scope. It takes experience. It takes people who actually use the scopes and accessories they sell. At ***astronomics,*** we have that experience. We've been selling telescopes for 16 years. Some of us have been using them far longer than that. From $329 to $16,000, we'll help you pick the telescope and accessories that fit your needs . . . *and your budget.* Meade, Celestron, TeleVue, Edmund, Questar, and more – we have *all* the good stuff.

astronomics. No hard sell. No guesswork. Just honest advice, the *right* scope . . . and a good price.

Call us at (405) 364-4898 and find out for yourself. Our years of experience are yours for free.

We have Meade Advanced Products – scopes and accessories – *in stock!*

Whether it's a complete Meade scope like the basic 2080B above, or the latest computerized LX200; or one of the new Meade Pictor CCD cameras; or even just a simple Meade accessory like an eyepiece, a filter, a Barlow, or a camera adapter – if Meade makes it for a dealer to keep in stock, chances are good we have it in stock.

Meade prices are usually the same anywhere you call. So there's no sense in buying from a dealer who takes your money (and sometimes takes more money than he advertises), then makes you wait and wait 'til he gets around to ordering what you want from Meade. Not when you can get what you want *right now* . . . from ***astronomics.***

We have both Meade and SBIG CCD imaging cameras – *in stock!*

As a Meade Advanced Products dealer, and one of only three telescope dealers in the U. S. authorized to stock SBIG products, we are uniquely qualified to offer you the widest possible choice of CCD autoguiders and electronic imaging cameras. We have the inexpensive entry level Meade Pictor 201 and SBIG ST-4 autoguiders that automatically guide long exposure 35mm deep space photos with most Meade and Celestron telescopes. (The ST-4 can also electronically record images of faint deep space objects on your computer's hard drive in mere minutes.) We have the unique 12-bit/16-bit selectable A/D conversion rate Meade Pictor 216 autoguider/imager. We have limited quantities of the new SBIG ST-7 and mega-pixel ST-8, each of which has two CCD chips for simultaneous guiding and high resolution imaging. From $405 to $7035, we can recommend the CCD guiding and imaging equipment that's right for your needs and your budget. If it's a CCD autoguider or imager from Meade or SBIG, the chances are good we have it in stock.

TeleVue Pronto, Genesis Sky Tour & DayStar H-alpha filters in stock!

At ***astronomics,*** we carry DayStar T-Scanner solar prominence filters in stock and the entire TeleVue line – eyepieces, Pronto and Genesis-sdf refractors, Barlows, Genesis Sky Tour packages, and more. And we have for over 12 years.

We've supplied DayStar ATM H-Alpha solar prominence filters to universities for their treasured Alvan Clark refractors, DayStar T-Scanners to high schools for their Schmidt-Cassegrains, and to individuals for the ultra-premium Questar Maksutov-Cassegrains that we also sell. And we can supply *you* with a DayStar H-Alpha filter for your refractor, Schmidt-Cassegrain, or Maksutov – at a price that saves you money.

More than just the sunspots you see with an ordinary glass solar filter, the DayStar Hydrogen-Alpha filters show you an amazing and ever-changing daytime display of solar prominences, flares, spicules, granulation, and more – doubling the amount of use you can get from your telescope. Write us for details.

And if you want a superb telescope to use with your DayStar filter, you'd be hard-pressed to beat the TeleVue Genesis-sdf 4" refractor. We keep the Genesis-sdf in stock, along with the Genesis Sky Tour package (with computer, free 7mm Nagler eyepiece and 1.8x Barlow, and more), and the Genesis and Pronto solar kits (that let you use the Genesis or Pronto with a DayStar H-Alpha filter), as well.

Want to pick the right Celestron or Meade scope? Our free catalog tells you how!

Call us at (405) 364-0858 for your *free* copy of our complete catalog 95AST with details and specifications on the many telescopes and accessories we keep in stock – from Celestron, DayStar, Edmund, JMI, Lumicon, Meade, Questar, SBIG, TeleVue, and more. We'll also include our 8-page guide on how to pick the right telescope, your discount prices on all of the products we carry, and some unadvertised special sale prices on used, demo, and closeout equipment. The catalog is yours for only the cost of a one minute telephone call. The information we send you will make it the most informative and useful one minute that you'll ever invest in astronomy.

Again many thanks for your help – it is the reason I placed this order with you.

Customer Quote of the Month #37

astronomics

Our 16th year of friendly service, good advice, and money-saving prices.

2401 Tee Circle, Suites 105/106, Norman, OK 73069

Toll-Free Order Line: **(800) 422-7876** Catalogs/Questions/Advice: **(405) 364-0858**

Our Hours: Monday thru Friday, 10:00 AM to 5:00 PM CST. 24-Hour FAX: (405) 447-3337 U. S. Sales only

We accept Mastercard, Visa, Discover, Optima, and American Express. $5 minimum freight

$40 Meade Plossl's!

Shutan Stocks Almost Every Meade Telescope!

NEW!

Meade Series 3000 Plossl Eyepieces:
5, 6.7, 9.5, 16, or 25mm
- Made in Japan
- Multi-coated
- 4-element!

Now 33% Off
Only $40 ea.
40mm S3000 Plossl in stock for only $70

New! Meade Pictor Series CCD Autoguiders and Imagers from $395
Send $3 for Full-Line 1995 Meade Catalog!

Meade Barlows:	
#122 2x 1.25"	$48
#127 2-3x 1.25"	60
#134 2x .96"	40
#140 2x 1.25"	80
2045 Accy's:	
Barlow 126 2x	48
Car cord	20
Carrying case	80
Tripod & wedge	265
Starfinder Accy's:	
Dust caps	call
Dec 55	78
Drive 43 110v-12v	129
Drive 47M (6-8-10)	429
Drive 48RS (16")	499

Misc. Meade	
Accy case 50	$67
Car cord LX200	85
Diagonal 1.25"	42
Diagonal .96-1.25"	28
Diagonal .96" 45°	53
Diagonal 1.25" 45°	53
Diagonal 929 2"	call
EP holder 1.25"	25
Focuser 70 1.25"	49
Focuser 680 2"	100
Focuser 682 2"	100
Finder brkt-8x50	25
Finder 544-8x50	70
Finder 545-8x50	70
Finder 634-6x30	50

Filter set of 4	$55
Filter set of 8	99
Filter set of 12	145
Filter ND96 1.25"	18
IBM software-200	100
Illum 12mm w/cord	80
Illum 12mm-wless	100
Illum 9mm w/cord	130
Illum 9mm-wless	150
Lenshood 8"	114
Lenshood 10"	124
Nebula 908B	80
Nebula 908N	90
Nebula 911B	100
Nebula 911N	120
Object libraries	call

Off-axis guider	$80
Piggy bracket	32
Reducer f:6.3	130
Skylight/seal	48
Tele extender	30
Tele ext-variable	40
T-adapt: SC	27
T-adapt: vari-proj	40
T-adapt: .96"	30
T-adapt: 1.25"	30
T-rings	16
Vari pol 905	50
Weight set 8"	85
Weight set 10"	90
Wedge 8"	134
Wedge 10" Super	395

Meade Series 4000 Eyepieces:	
Super Plossl 6.4, 9.7, 12.4, 15, 20, 26	$88
SP32 or 40mm	110
SP56mm	230
Super Wide 13.8	160
Super Wide 18	170
Super Wide 24.5	199
Super Wide 32	280
Super Wide 40	340
Ultra Wide 4.7	180
Ultra Wide 6.7	220
Ultra Wide 8.8	270
Ultra Wide 14	330

Ask about our Special $12 UPS AIR Accessory Delivery!

Jim's Mobile
Moves in-out

Zero-Image-Shift Electric Focus!
Fits ALL Meade and Celestron SCT's!
$189 1.25"
2-inch NGF-S $269

LX200 Keypad Holder
$32

Leveling Wheels!
Fits any Meade
8"/10" SCT, 4"/5" APO, and Starfinder 6"/8"/10"
$138

Telrad
In Stock!

TeleVue

Genesis SDF	Call
Pronto	Call
Renaissance	Call
Panoramic mt	349
Gibraltar mt	449
Starbeam-T	179
Cam. adapter	39
Piggycam	45
Eyepiece proj	69

Ext tube	$33
CXD-1 motor	234
Polar finder	119
Air Chair	139
Nagler:	
4.8mm New!	168
7mm New!	216
9mm	234
12mm Type2	275
16mm Type2	299
20mm Type2	368

Plossl:	
7.4, 10.5, or 13	$ 70
17, 21, or 26	70
32 or 40mm	109
55mm	224
Wide Field:	
15mm	132
19mm	140
32mm	234
Paracorr 1.25"	139
Paracorr 2"	228

Panoptic:	
15mm	$204
22mm	269
27mm	319
35mm	354
Barlow interface	94
Barlows:	
1.8x	84
2.5x	84
Big Barlow 2"	162

Sale!
Foam Lined Accessory Case!
Large! 13x19x7" $50

Celestron

C5+ w/wedge	Call
C8+ w/wedge	Call
C5 tripod	259
C5 fitted case	137
C5 lenshood	49
Dew shield-8"	29
F:6.3 reducer	125
MFFT-55	159
Ultima 2x 1.25"	79

Kendrick

12v Controller	$59
1.25"/2" heater	33
8" heater	48
10"/11" heater	59
12" heater	68
8" dew shield	43
10" dew shield	53
12" dew shield	74

Call for other sizes!

1000 Oaks Solar Filters

4" full-aperture	$ 70
5" full-aperture	90
8" full-aperture	115
10" full-aperture	129

Other sizes in stock!

Precision polished glass, triple-coated in machined aluminum cell. Image is yellow-orange— no need for secondary filtering!

Konica
ASA 3200 Color Print
4-24 exp. rolls $27

Call for FREE 1995 Discount Buying Guide!
NO CREDIT CARD SURCHARGE! Shutan is family owned **AND** operated since 1918! Order by **NOON** for same-day shipment. Don't be **FOOLED** by other stores with tons of fine print in their ad! We ship most acc'y orders UPS Ground for just **$5.00.** Call for $12 UPS AIR info. Call for telescope prices & stock status. *Prices subject to change.*

Call Us Toll-Free 800-621-2248 • Ilinois 312-332-2000

SHUTAN
camera & video

312 W. Randolph • Chicago • 60606
M-F 8:30-5:30 • Saturday 9-5

VISA MasterCard DISCOVER AMERICAN EXPRESS

LETTERS

It may interest Alister and other readers that at least one doctoral dissertation and later an article in the *Astronomical Journal* each addressed this issue.

My dissertation was titled "Dust in Globular Star Clusters" (University of Illinois, 1977). I later published the article "Dust Patches in Globular Clusters" with Stanley P. Wyatt in *AJ*, **83**:779, July 1978. Both papers report microphotometer studies as well as theoretical arguments for the dust cloud identity of the Y-shaped structure in the outer regions of M13, along with similar studies of M15 and other Population II objects apparently containing clouds of dust. — *Sherman P. Kanagy II, Charleston Southern University, Charleston, South Carolina*

Stellafane ATM Report

The article "Amateurs Gather in Vermont and Missouri" (December 1994) included coverage of the Stellafane convention held on Breezy Hill near Springfield, Vermont, in August 1994. Your article stated the mirror-grinding workshop was sponsored by the ATMs of Boston whereas it was actually put on by the Springfield Telescope Makers.

Of course we appreciate the article and the mention of the mirror-grinding workshop in particular. It was a new event this past summer and because of its outstanding success, we plan to continue and expand it next summer. — *Thomas J. Spirock, Secretary, Springfield Telescope Makers, Belleville, New Jersey*

Corrections

"Telescopes that Fly" (November 1994) contained an incorrect e-mail address for obtaining information about the FOSTER program. The Gopher address should be **quest.arc.nasa.gov**. World Wide Web users can obtain information about airborne astronomy at **http://airsci-www.arc.nasa.gov/**. Gopher users can go to **gopher://quest.arc.nasa.gov/1**.

The photos in Luke Dodd's "Under the Southern Sky, Part II" (December 1994) were taken from Loomberah, New South Wales, and the dark features in several of them were highlighted by carefully burning in prints while in the darkroom. □

---

*ASTRONOMY welcomes feedback. Send your letters to ASTRONOMY Letters, P.O. Box 1612, Waukesha, WI 53187-1612, or on the Internet, use **72000.2704@CompuServe.com**. Letters may be edited for length and clarity.*

TUTHILL, YOUR ASTRONOMICAL FRIEND ONCE AGAIN RELATES THE FACTS ABOUT SOLAR FILTERS

SAFETY - The aluminum-coated glass and Solar Skreen® optical-grade, aluminum-coated Mylar® filters on the market are safe. These two types are in current safe use on the Sun by thousands of professionals and amateurs around the world every day.

QUALITY OF THE IMAGE - The difference between the two types of filters is the quality of the Sun's image. The quality of the image produced by inexpensive glass filters is poorer than Solar Skreen® because glass filters are not polished flat on each side but are made from commercial window glass which is not necessarily strain free. In the Solar Skreen® filter the tough optical-grade, aluminum-coated Mylar® is so thin that it literally does not exist in the optical path. Because of this fact it does not degrade the image.

COLOR - Some glass filters have coatings that make the Sun different colors. In contrast aluminum-coated Mylar® sometimes can give a pale blue image of the Sun if the aluminum and Mylar® materials are too heavy. However, with Solar Skreen®, the optical grade Mylar® is thin and the aluminum coating is selected to make the Sun a cool, pleasing, pearly off-white color, giving a restful, easily-viewed image. If you request one we will supply a FREE color correcting filter with each assembly.

BREAKAGE - It is true that with a concerted effort you can poke a hole through the dual tough Mylar® layers. However, unlike glass, you can drop the Solar Skreen® filter assembly on concrete without breaking it. If a hole ever does develop, it can be repaired easily with a piece of black tape. *SEE GUARANTEE BELOW.*

SOLAR SKREEN®

PINHOLES - If present in either type, pinholes do not reduce the safety - they only reduce the contrast of the image. In the Solar Skreen®, pinholes are overcome by the fact that two layers of aluminum-coated Mylar® make up the filter. The secret is in these two separate coatings which do not allow random small pin holes to line up. On the other hand, to try to accomplish this effect on a glass filter, with a layer of metal on each side of the glass, unacceptable double images would result.

FINALLY - THE SOLAR SKREEN® CHALLENGE - A PERFORMANCE GUARANTEE - Buy a Solar Skreen® filter assembly from us and buy any competing glass filter. Compare them at the same time under the same conditions. **IF OUR SOLAR SKREEN® FILTER DOES NOT SHOW FINER DETAIL ON THE SUN THAN THE COMPETITIVE FILTER, NOT ONLY WILL WE RETURN YOUR MONEY *BUT WE MAY LET YOU KEEP THE FILTER!!*** SEE IF YOU CAN GET THAT GUARANTEE FROM ANY COMPETITOR. In addition we offer a ***FREE LIFE-TIME REPLACEMENT*** - If the Solar Skreen® material becomes damaged for any reason, we replace it **FREE.**

ECLIPSES - If you are interested in the next few solar eclipses, we have world famous Solar Skreen® Eclipse glasses available for clubs to help in fund raising.

Time Payment, C.O.D., VISA and MasterCard.

For info or orders call 908-232-1786; 800-223-1063 • Fax 908-232-3804.

Send a 9" x 12" self-addressed envelope with 4 stamps for our complete information and FREE Solar Skreen® sample.

. . . WE CLEAN, REPAIR, AND REFURBISH ALL SCHMIDT-CASS TELESCOPES . . .

ASK ABOUT OUR TWO-TIER SCOPE PRICING

Roger W. Tuthill, Inc., Box 1086-A, Mountainside, NJ 07092

ASTRO FORUM

People of the Sun

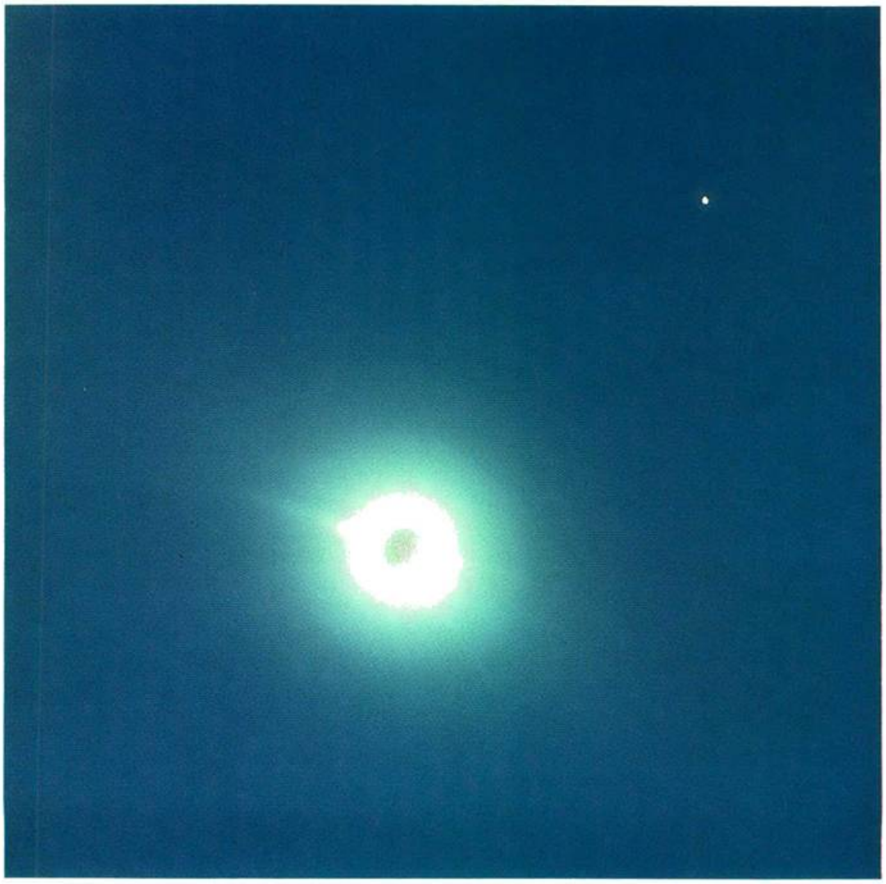
by Seth Shostak

The only total solar eclipse of 1994 occurred on November 3 in the Southern Hemisphere. The Moon's shadow sliced across the waist of South America and then flitted across the Atlantic toward Africa. For eclipse chasers, the best bet for enjoying this lunar sunblock involved traveling to the high, dry plains of Peru, Bolivia, or Chile.

Those who made this trip met some of the most daunting topography in the world. The Pacific coast is bordered with a rocky, bone-dry desert. A few hundred miles east stand the choking jungles of the Amazon basin. Between jungle and desert lie the steep, tectonically active Andes. A half-millennium ago, this territory housed tens of millions of inhabitants, long-forgotten subjects in the extended, highly organized Incan empire. The principal god of the Incas was the Sun. Alas, this brilliant deity seems to have done little to protect the Andean people against foreign invaders. In 1532, Francisco Pizarro and a few hundred horse soldiers brought down this mighty empire in an afternoon. The pagan temples and rites of the Incas were aggressively eradicated by the Spanish. The Sun god was purged and forgotten.

How ironic, then, that in the autumn of 1994 the mountainous redoubts of Peru were once again invaded by foreigners, no longer intent on purging the Sun but in pursuing it. Peru's new invasion was brought to the locals courtesy of inexpensive jet travel.

And so it was that in the early morning hours of November 3, 60 people sat in a darkened tour bus nosing its way through low, unlit rural neighborhoods of Arequipa, Peru, a hundred miles from the Chilean border. Despite the lack of sleep and the cold, palpable excitement energized the Americans crowded into the bus. They had come to this remote spot as participants in an eclipse tour, and the promise was three minutes of spectacle. Their easy mobility contrasted


Jeffrey R. Schroeder

MAINTENANCE MASTER
The Complete Telescope Cleaning and Protection Kit

- ✓ 3 optical cleaning solutions including Quantum Clean, not found in any store
- ✓ Tube Polish with scratch guard
- ✓ Casting Cleaner
- ✓ Compressed air with 3 ft. ext. tube for inside surface dusting
- ✓ Camel hair brush
- ✓ Electronic port protection plugs
- ✓ And much more

Over 200 Cleanings

Developed by a former QC manager of a leading telescope manufacturer, these products have been tested on over 1000 telescopes and have proven to be the best.

Dealers Welcome

Protect your investment – order today.
Intro. offer: $79.95 + $3.99 S/H to:
4-6 wk. delivery
Quantum Creations
Suite 429, Dept. A • 709 Route 206
Belle Meade, NJ 08502-1599 • 908-359-7057

CCD IMAGING EQUIPMENT™

- Cameras
- Filter Wheels Manual & Remote
- ALL CCD Filters
- Flip Mirrors
- Beam Splitters
- 1.25, 2-in. & T-mounts

Equipment for **ALL** CCDs **AND** visual use

Flip Mirror

MURNAGHAN™ Instruments
1781 Primrose Ln., W. Palm Beach, FL 33414
Phone: 407-795-2201 • FAX: 407-795-9889
Internet: murni @ bix.com
BBS 407-795-0979

HOME-DOME® & PRO-DOME™

- **True Rotating Dome**
- **6, 10, or 15 ft. Diameter**
- **Wide Slot Openings**
- **Easy Assembly**
- **All Fiberglass**
- **Complete Systems Priced from $1950**

Now Available! $7.95
"AT HOME IN A DOME"
75 pages of observatory design ideas.

Technical Innovations, Inc.
22500 Old Hundred Road
Barnesville, MD 20838
301-972-8040

FREE Brochure

CELESTRON BINOCULARS

CELESTRON offers a complete line of binoculars for a variety of interests such as nature study, sporting events, birding, travel, target shooting, backpacking and last but not least – astronomy.

Although many of the smaller aperture **Celestron** binoculars (25 to 44mm) are useful for various astronomical applications, we will only discuss here our larger aperture (50mm and larger) models.

All binoculars are of the porro prism design. **Celestron** binoculars provide a long term investment in quality and satisfaction and carry a limited lifetime warranty.

Nature Series – These units are economically priced but still have very good optics. They have BK-7 prisms and are fully coated. The body has a rubber armor covering.

7x50	6.8°	13mm	25 oz.
9.5x50	7.0°	13mm	25 oz.
8x56	6.5°	16mm	29 oz.

Ultima Series – The Ultimas are sleek in appearance with superb image quality. They have BAK-4 prisms and are fully multi-coated. The Ultimas have a soft leatherette finish and are extremely lightweight.

7x50	7.0°	20mm	27 oz.
10x50	5.0°	21mm	27 oz.
8x56	6.1°	21mm	31 oz.

Pro Series – This series is a popular priced line that optically performs well against more expensive models. They feature BAK-4 prisms and are fully multi-coated. The Pro line has a thin rubber covering and they are lightweight.

7x50	7.1°	23mm	29 oz.
10x50	6.5°	15mm	30 oz.
12x50	5.5°	10mm	29 oz.
8x56	5.8°	22mm	34 oz.
9x63	5.0°	21mm	37 oz.

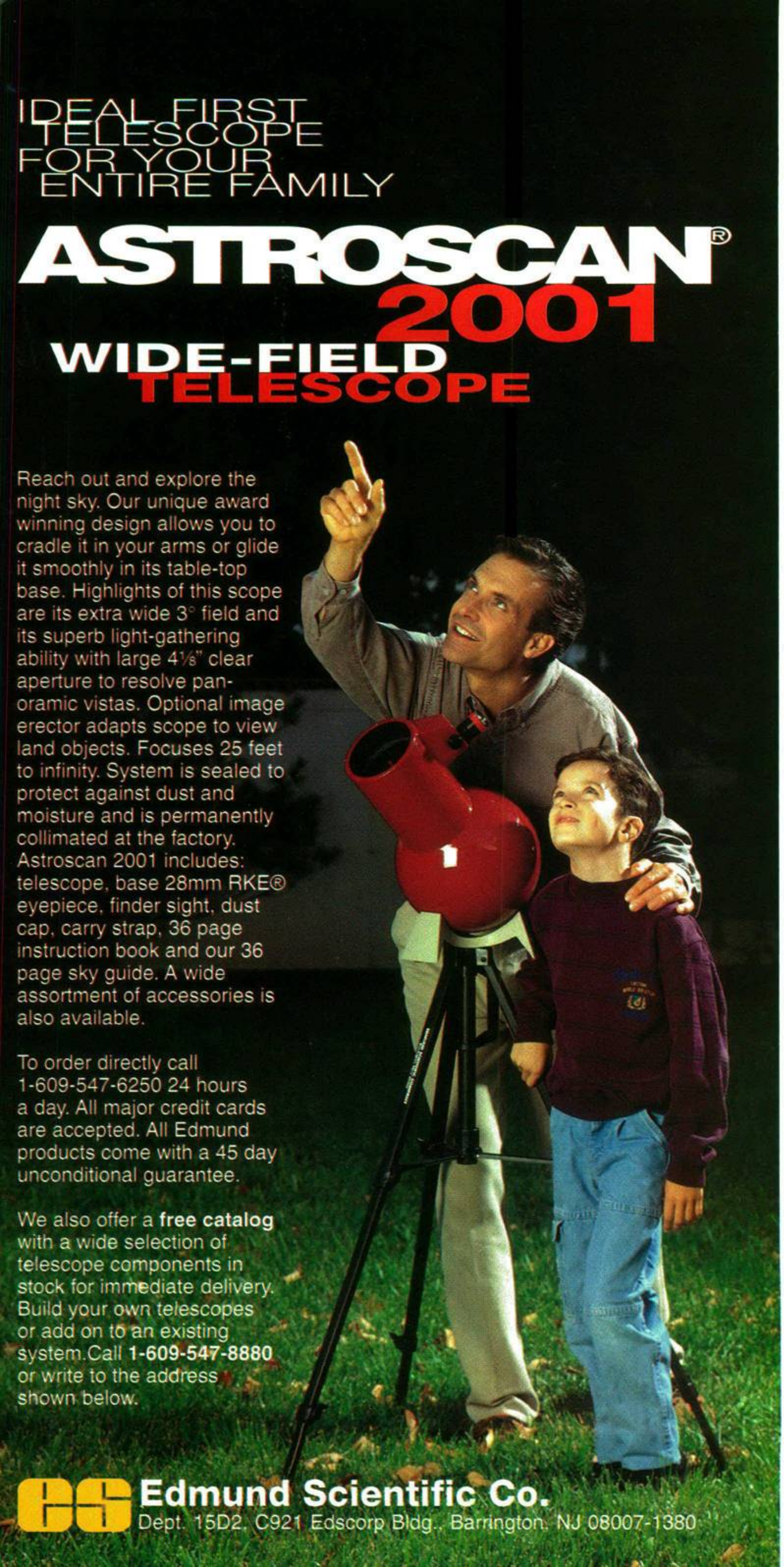
Giant Series – The new Celestron Giant Series are of a much higher optical and mechanical quality than traditional 80mm binoculars offered in the marketplace. They feature BAK-4 prisms and are fully multi-coated. Added structural reinforcement ensures stability and makes collimation retention reliable.

12x80	4.5°	18mm	89 oz.
20x80	3.5°	16mm	89 oz.

CELESTRON®

To find out more about these Binoculars, contact a Celestron dealer or Celestron.

Celestron International • 2835 Columbia Street, Torrance, CA 90503 • (310) 328-9560 • FAX (310) 212-5835



IDEAL FIRST TELESCOPE FOR YOUR ENTIRE FAMILY

ASTROSCAN® 2001 WIDE-FIELD TELESCOPE

Reach out and explore the night sky. Our unique award winning design allows you to cradle it in your arms or glide it smoothly in its table-top base. Highlights of this scope are its extra wide 3° field and its superb light-gathering ability with large 4⅛" clear aperture to resolve panoramic vistas. Optional image erector adapts scope to view land objects. Focuses 25 feet to infinity. System is sealed to protect against dust and moisture and is permanently collimated at the factory. Astroscan 2001 includes: telescope, base 28mm RKE® eyepiece, finder sight, dust cap, carry strap, 36 page instruction book and our 36 page sky guide. A wide assortment of accessories is also available.

To order directly call 1-609-547-6250 24 hours a day. All major credit cards are accepted. All Edmund products come with a 45 day unconditional guarantee.

We also offer a **free catalog** with a wide selection of telescope components in stock for immediate delivery. Build your own telescopes or add on to an existing system.Call **1-609-547-8880** or write to the address shown below.

Edmund Scientific Co.
Dept. 15D2, C921 Edscorp Bldg., Barrington, NJ 08007-1380

sharply with the tethered lives of the local campesinos, whose livestock and poverty would eternally moor them to this small speck in a vast continent.

The bus suddenly pulled to the side of the dirt road and halted to the wheeze of airbrakes. In the blue illumination of early twilight, five dozen passengers wrestled tripods, cameras, and small telescopes from overhead racks and banged and bumped their way to the door. Cold air swept through the bus. A bearded fellow proudly sporting an eclipse T-shirt remarked that it seemed "a bit cloudy." His dispiriting observation hung for a moment in silence. Everyone had already noticed.

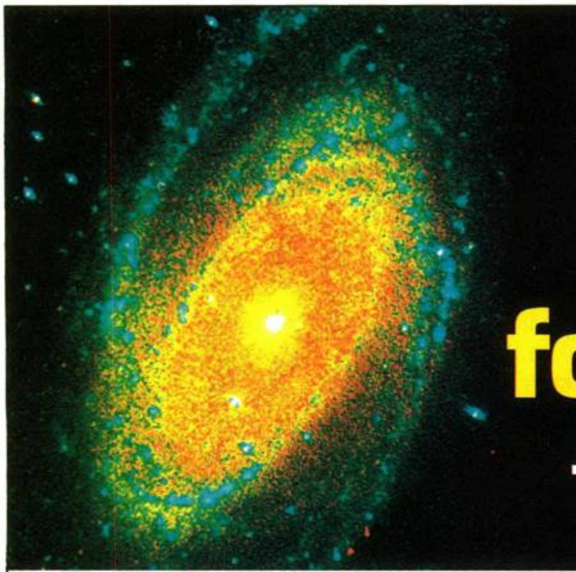
The Sun was now a white cookie with a small, perfect bite taken out of it.

Various parties in the tour group carefully staked out their positions. The shadow they had come to see would travel a few hundred thousand miles, but somehow the arrangements for the last 100 feet seemed important. With shivering hands, tripod feet were stuck in the sand, and mylar filters were taped over the lenses.

Now the stage was set. Into a brightening eastern sky, the star of the drama rose like a brilliant beacon over the blackness of the mountains. It had been preceded by the unseen Moon, moving silently toward that magical place between Earth and Sun. There was still an hour before the eclipse began, and the time was spent in small talk dealing with the fine points of astrophotography, laced with apprehensive discussions about the intermittent but persistent low clouds that moved sluggishly across the eastern sky.

The eclipse began with a shout. "It's started!" exclaimed one of the tourists, as she ran to adjust her camera. The Sun was now a white cookie with a small, perfect bite taken out of it. Clearly visible sunspots decorated the cookie.

Successful in its first assault, the Moon steadily advanced on the supreme god of the Incas. After the first half hour, the light was noticeably fainter. Fifteen minutes later, the light was halved again. The exponential dimming was a prelude to the main event. But now a general



Choose any 1 of 3 sets for just $2.95

— Values to $119.95 —

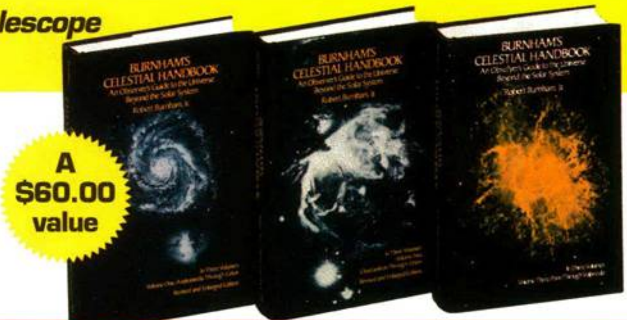
As your introduction to the Astronomy Book Club

You simply agree to buy three more books — at significant savings — within the next 12 months.

"A wealth of information...a classic" – Sky & Telescope

1. Burnham's Celestial Handbook

- Observe over 7,000 deep-sky objects with just a backyard telescope
- Includes detailed descriptions of the most important stars, nebulae, and galaxies in each constellation
- Over 650 finder charts, and diagrams


BURNHAM'S CELESTIAL HANDBOOK
A $60.00 value

SEEING THE DEEP SKY Telescopic Astronomy Projects Beyond the Solar System
Fred Schaaf
SEEING the SKY 100 Projects, Activities & Explorations in Astronomy
Fred Schaaf
SEEING the SOLAR SYSTEM Telescopic Projects, Activities & Explorations in Astronomy
Fred Schaaf
An $84.85 value

Observe the universe from your backyard with...

2. Fred Schaaf's Seeing the Universe Set

- Over 180 of noted columnist Fred Schaaf's favorite projects, activities and explorations
- Covers the sky, the solar system, and the outer limits of the universe
- Requires little more than a basic telescope or your own eyes

Journey through our solar system...

3. The Solar System Library

- Explore the evolution and geology of planets and moons
- Survey the history of planetary observation from the ancients to today's space probes
- Includes over 100 lavish full-color photos from the interplanetary probes

MOONS & PLANETS
William K. Hartmann
THE PLANETS
NIGEL HENBEST
Worlds in the Sky
William Sheehan
A $119.95 value

MEMBERSHIP BENEFITS

In addition to getting the set of your choice for only $2.95 when you join, you keep saving substantially with discounts of up to 50% off the publishers' prices on books you choose to purchase. • Also, you will immediately become eligible to participate in our Bonus Book Plan. • Moreover, our books are always identical to the publisher's editions. You'll never receive an "economy edition" with inferior paper and bindings from us. • At 3-4 week intervals (16 times per year), you will receive the Astronomy Book Club News, describing the coming Main Selection and Alternate Selections, together with a dated reply card. • In addition, up to four times a year, you may receive offers of Special Selections which will be made available to a group of select members. • If you want the Main Selection, do nothing, and it will be sent to you automatically. • If you prefer another selection, or no book at all, simply indicate your choice on the card and return it by the date specified. • You will have at least 10 days to decide. If, because of late mail delivery of the News, you should receive a book you do not want, we guarantee return postage.

Whether you're a professional or amateur enthusiast, the Astronomy Book Club offers you the finest astronomy materials available. You'll enjoy atlases and how-to manuals, as well as textbooks and popular guides covering the latest discoveries, and the opportunity to purchase them conveniently and inexpensively. All books are available to you at significant savings, with prices starting as low as $9.95.

If reply card is missing, please write to Astronomy Book Club, Dept. L-DP5, 3000 Cindel Drive, Delran, NJ 08370-0001, for membership information and an application.

© Newbridge Communications, Inc. Astronomy 4/95 disquiet was sweeping the crowd. The clouds had failed to dissipate. Although they were far from opaque, they would compromise the view during totality. Only a few miles to the west, one could see unimpeded sunlight reaching the hills. Should the observers try to move? Mobility is often the key to successful eclipse watching, but every minute that passed lessened the chances of traveling to anywhere better than where they were. With 60 people involved, the decision to go was a complicated one.

With a low diesel growl, the tour bus lurched at unnerving speed across the desert tracks, headed southwest. The minutes to totality could be counted on one hand, and panic crept through the crowd. As bad as clouds were, they sure beat watching the eclipse through the roof of a bus. Finally, someone spoke in half-English, half-Spanish to the driver, and ordered him to pull over. The bus had come maybe four miles. There was a mad scramble to get out, and lens caps went flying. The Sun was now no more than a thin crescent. The clouds were still there.

Someone noticed the approaching shadow of the Moon racing silently over the western hills at a mile a second. In a few moments, the last facets of sunlight were extinguished, and rather suddenly the bright rings of the chromosphere and inner corona popped into view. The Sun was a dark circular disk covered by a massive ball of dead rock. A few people cheered. Many clapped. The Sun god didn't seem to care.

Totality lasted three minutes. You can boil an egg in that time. This tour group took pictures. They also looked around at a sky that was dark everywhere but at the edges. There was audible complaint when the first beads of light signaled totality's end. A brief red flash appeared, and the bright disk of the Sun began to emerge. Totality was over.

An hour later, the god of the Incas was once more shining unimpeded on the descendants of that shattered empire. The spectacle was over, and 60 tourists from another continent returned to the bus with their equipment and their precious images. A foreign expedition had again come to the Andes. But unlike the ambitious Europeans of four centuries earlier, these invaders came and left peacefully. ☐

Seth Shostak is an eclipse chaser who works at the SETI Institute in Mountain View, California.

Pocono Mountain Optics

POCONO

INFORMATION: 717-842-1500 ***For All Your***

Tele Vue "WHEN YOU WANT THE FINEST"

We stock the entire Tele Vue line for immediate shipment. - All items also on display and available for purchase and pick up at our showroom.

All Eyepieces and Accessories at Winter Sale Prices — Call!!

Imagine a Walk in Space!

NAGLERS 82° Apparent Field of View

Patented Tele Vue Naglers offer the widest, sharpest views available. Why settle for a back seat view when you can experience a *spacewalk?*

Choose from 4.8, 7, 9, 12, 13, 16 and the amazing 20mm! Call us today for sharp prices and large selection!

Tack Sharp!

PANOPTICS 68° Apparent Field of View

Attack your sharpness problems with Tele Vue's newest eyepiece — the Panoptics. The 2″ 35mm and 27mm are considered to be the sharpest in their focal length class. The 1¼″ 22mm and 15mm offer outstanding performance, lighter weight, smaller size and lower cost when compared with similar focal length Naglers.

Tele Vue's Best Eyepiece Value!

PLOSSLS 50° Apparent Field of View

Patented Tele Vue Plossl eyepieces started the trend toward higher-quality, high-performance eyepiece designs. And today, despite the many imitators available, they still deliver the sharpest views in their class. And buying Tele Vue Plossls is the smart way to stretch your astro dollar. Our stock selection includes 1¼″, 7.4, 10.5, 13, 17, 21, 26, 32, 40 fl. And don't forget the 2″ 55mm, which yields the widest true FOV available.

PRONTO

70MM AP.F6.8, 480MM F.L.
Available in 1¼″ Image Erect, 1¼″ Star Diagonal and 2″ Star Diagonal models.
"The little scope — that could"

SKY TOUR
Has Arrived!

Exciting Sale Priced Packages for Genesis and Gibraltar — contact us for exciting details which include Free Eyepieces, Solar Filter and More!!

Pocono Mountain Optics is your Tele Vue headquarters! Give us a call today, and see why our selection, price and service are second to none!

The Kendrick Dew Remover System for all size scopes, finders and mirrors

Dew Controller (Works up to 4 Heaters)	$58.00	7″/8 Dew Heater	$47.00
120 Volt Conversion Kit	$38.00	10″/11″ Dew Heater	$58.00
.956″/1.25″ Eyepiece Dew Heater	$30.00	12″ Dew Heater	$67.00
1.25″/2″ Eyepiece Dew Heater	$32.00	14″/16″ Dew Heater	$74.00
2″ Dew Heater	$34.00	Telrad Heater	$32.00
3″ Dew Heater	$38.00	1.83″/2.14″ Secondary Heater	$35.00
4″ Dew Heater	$41.00	2.60″/3.50″ Secondary Heater	$41.00
5″ Dew Heater	$43.00	4.00″ and up Secondary Heater	$42.00
5.5″/6.5″ Dew Heater	$44.00		

New Flexible Dew Shields from Kendrick

5″ – $28	8″ – $42	10″ – $52
11″ – $62	12″ – $73	14″ – $92

KWIK FOCUS

Enjoy perfectly focused photos with Kwik Focus focusing device

8″ SCT Lens Cap	$39.95
10″ & 11″ SCT Lens Cap	$44.95
12″ & 16″ SCT Now Available	

12 AMP HR.
Heavy-Duty PORTA-PAC
$86.95
PORTA-PAC 5 AMP HR $65.00

BEATTIE INTENSCREEN-PLUS
Ultra bright focus screens for:

Olympus OM - 1, 2, 3, 4	$62.00
Nikon F, F2, F3	$93.95
Nikon FE, FE2, FM2, FA	$62.00

Visit our sales booth at the North Eastern Astronomy Forum Telescope Show at the Holiday Inn in Suffern, NY on Sunday, April 2, 1995.

Pocono Mountain Optics

POCONO MOUNTAIN OPTICS

ORDERS - TOLL FREE: 800-569-4323 till 9 P.M., 7 days a week

Information: 717-842-1500 till 9 P.M. FAX (24 hours) 717-842-1408

MOUNTAIN OPTICS

Astronomical Needs **FOR ORDERS — TOLL FREE: 800-569-4323**

OBSERVE IN COMFORT

with STAR-BOUND

VIEWING CHAIR

- **Portable, Adjustable from 9″ to 32″**
- **Padded Seat**
- **Porcelain Black Powder Coated**

$159.00

BINOCULAR SPECIALS

Fujinon

FMT SERIES

Ideal for Astronomy

6x30 FMTR-SX	$348.00
10x70 FMT-SX	$479.00
7x50 FMT-SX	$398.00
16x70 FMT-SX	$540.00
7x50 FMTR-SX	$459.00
Tripod Adapter	$ 15.00
8x40 BFL Close Focus w/lock	$229.00

We also carry and stock Zeiss, Swarovski, Swift, Nikon, Aus Jena, Pentax, B&L, Steiner, Minolta and Kowa spotting scopes.

SPECIAL PURCHASE

10x30 Adlerblick	$109.00

NEW — LASER COLLIMATOR

Make Mechanical And Optical Alignment A Snap With New AstroSystems Laser Collimator. Safe, 5 Milli Watt Red Laser Diode. Operates From 3 AA Batteries. Works With All Standard 1.25″ And 2 Inch Focusers.

Introductory Price: $155.

JIM'S MOBILE

We stock the entire JMI line — Call us and save.

Moto-Focus LX3/5/6/200	**$79.00**
Moto-Decs LX3/5/6	**$75.00**

Moto-Focus and Moto-Decs for all scopes available. Contact us for special sale prices on NGC Mini Max, NGC Max, Micro Max.

New — NFG-2 Deluxe Focuser (used on NGTs) with or without motor focus.

SPECIAL — Eliminate Image Shift with NGF-S Focuser **$269.00**

MK-65 in Stock	**Call**

Tectron Collimators Improve Newtonian Images with the following:

Sight Tube	$29.00
Cheshire Eyep.	$38.00
Auto-collimator	$31.00
Above 3 w/Bklt.	$95.00
New "Revised" Booklet on Collimation	$ 6.00

For that Fast New Scope You're building or for upgrading your current scope —

New — The Modern Dobsonian Booklet	$11.00
Ultra Low Rack & Pinion Focuser 2″ w/11/4″ Adapter	$125.00
Photographic Focuser	$159.00

THOUSAND OAKS

THOUSAND OAKS SOLAR FILTERS

— The Best —

See actual sunspots safely with your telescope

Type I 8″	$88.00	Type II 8″	$115.00
Type I 10″	$98.00	Type II 10″	$128.00

ALL sizes available for all scopes.
Type III and new thread ins available.

NEW SOLAR PROMINENCE FILTERS

See solar prominences with your refractor or Cassegrain with new Thousand Oaks Optics Solar Prominence Packages. Contact us for introductory specials.

EYEPIECE SPECIALS!!

Buy Direct and Save

Coated and threaded for filters:

11/4″ Kellners 6, 9, 12, 18, 25MM	$29.95
11/4″ Orthos 4, 5MM	$46.95
11/4″ Orthos 6, 7, 9, 12.5, 18, 25MM	$44.95

11/4″ ERFLES

16MM	$ 58.00	25MM	$62.00
20MM	$ 60.00	32MM	$70.00
2″ Erfle 32MM	$125.00	11/4″ 2x Barlow	$39.00
11/4″ 8.4-21 ZOOM			$85.00

Vixen LV Eyepieces in stock from $94.00

ALL LUMICON FILTERS IN STOCK
We carry D&G Refractors;
Tech 2000 Dob Drives
We are an authorized Parks Dealer.
Contact us for Daystar-T-Scanners
University Optics Dealer

LUMICON

Deep Sky Filters 1.25″	**$79.50**
UHC/OX3/H-Beta 1.25″	**$99.50 ea.**

48MM sizes in stock

LOSMANDY GM8 Mount

Complete System

Mount, Polar Filter and Illuminator Dual Axis, PEC DRIVE, Adapter Plate. (Specify Telescope)

$1395.00

We are a dealer for all Losmandy Secondary System Products.

TELRAD w/Base
$39.00
Batteries included!

Hinged Deluxe Dew Caps	$10.00
Extra Bases	$ 7.95
Extra Reticles	$ 2.95
Pulsar Unit	$19.95

QUESTAR

We are a stocking, authorized Questar Dealer. Please contact us for sale prices before you purchase!

SPECIAL PURCHASE — 3.5″ STD, Pyrex w/mag. fluoride and power guide. Factory sealed — Call!

EDMUND SCIENTIFIC

Astro Scan 2001
World Famous 41/4″ Portable Reflector Scope
$298.00

ASTRO SCAN ACCESSORIES

New Tripod for Astro Scan	**$87.00**
Tripod Bkt. **$41.95** Tote Bag	**$29.95**
Var. Cam. Ad.	**$74.95**
Sun Viewing Screen	**$45.95**
St. Thru Image Erector	**$59.00**

EYEPIECES & ACCESSORIES

11/4″ RKE 8, 12, 15, 21 or 28MM	**$41.95**
RKE 2.5x Barlow	**$64.95**

Edmund, Orthos, Kellners, Ortho ZOOM
Sale priced.
ALL EDMUND PRODUCTS AVAILABLE

CELESTRON

C-5 Plus

Sale Prices on All Celestron Scopes and Accessories

MEADE

We carry the full line of Meade Telescopes & Accessories

Meade Model No. 2080 8″ Schmidt-Cassegrain and model 2120 10″ Schmidt-Cassegrain

ASTRO SYSTEMS

We carry Astro Systems full line of telescope making equipment. Primary Mirror Cells, Secondary Holders, Heavy-Duty Spiders, Teflon Bearing Kits.

Announcing Enhanced Coated Secondary Mirrors
Intro. Prices

1.3″	**$38.00**	**2.6″**	**$ 83.00**
1.5″	**$44.00**	**3.1″**	**$105.00**
1.8″	**$56.00**	**3.5″**	**$219.00**
2.1″	**$68.00**	**4.0″**	**$269.00**

ACCESSORIES CORNER

T-Rings (spec. camera make)	$10.00
Tele-Extenders & T-Adapters for SCT's	$22.00
Color & Moon Filters 1.25	$12.00
(Set of 6) Color & Moon Filters 1.25	$59.95
Drives for Tasco Eq. Mount	$75.00
Anti-Vibration pads for Tripods	$40.00
Tripod Slo-mo controls	$ 36.00
New Deluxe Optics Cleaning Kit	$ 19.00
Celest. F6.3 Reducer/corrector	$118.00
Celest. Photo Deluxe Tripod	$ 95.00
12 Volt Dew Remover Blower	$ 11.95
Red LED Chartmaster flashlight	$ 17.50

BOOK & STAR CHARTS

MAG 5 Star Atlas	$ 6.50
MAG 6 Star Atlas	$16.95
Sky Atlas 2000 Field or Desk	$19.95
Sky Atlas 2000 Color	$40.00
NEW Sky Atlas Companion	$24.95
Laminated Deluxe 2000 Color	$84.95
Laminated 2000 Field or Desk	$58.95
Burnham's Handbook — All 3 Volumes	$39.95
Norton's Sky Atlas	$44.95
Uranometria Vol. I or II	$39.95
Astrophotography for the Amateur	$18.95
Astrophotography by Gordon	$18.95
Astrophotography II by Martinez	$18.95
Backyard Astronomers Guide	$39.00
Atlas of the Moon by Rukl	$27.95
Deep Sky Field Guide to Uranometria	$49.95
All About Telescopes by Edmund Scientific	$13.95
How to Choose Binoculars by A. Hale	$ 5.00
1000 +	$33.00
Atlas of Deep Sky Splendors	$39.00
New CCD Cookbook	$29.95
Star Ware	$19.95

NEW VE MINI TRAK

State-of-the-art, variable speed drive corrector, power inverter. Includes digital quartz tracking indicator — Easily hand held.

Complete with D.C. cord.
Sale Price $84.95

SPECTRA

SPECTRA ACCESSORIES SOLVE FOCUS PROBLEMS FOREVER

with Spectra's Sure-Sharp Optical Grid Focusing method for perfectly focused astrophotos

Sure-Sharp	$135.00
Point Source	$ 59.00
Rt. Angle viewer	$ 49.00
Duo-View	$ 79.00

Spectra Guide/Deluxe Radial Model — Call

COMPUTER SOFTWARE

"THE SKY" by Software Bisque

Levels 2 & 3 for DOS or WINDOWS
Level 3 includes CD ROM
GSC CD ROM version available.

Sky Pro software and computer scope interface kits in stock.

STARGAZE	$79.00
Red Shift — CD ROM for Mac or Windows	$55.00

Desert Storm Covers

Protect your investment — Covers available for all size scopes

Manufactured with a thick mylar "heat resistant" material

CCD Cameras have arrived!

Special — 8″ F-8 Primary Mirror, Call

QUARTZ DRIVE CORRECTORS BY VOGEL - All Digitrak II

SINGLE AXIS

VE-200 Runs off DC	$132.95
VE-300 Runs off DC/AC	$159.95
VE-400 Runs off DC/AC or Int. Battery	$198.95

DUAL AXIS

VE-200 D	$174.95
VE-300 D	$212.95
VE-400 D	$262.95
VE-100 Inverter (converts your motor to DC)	$ 71.95
Interface Cable for SBIG-4	$ 17.95

North Pocono Village Shopping Center • RR6, Box 6329 • Moscow, PA 18444

SHOWROOM HOURS 10 a.m. - 5 p.m.
Monday thru Saturday

We purchase and take in trade used telescopes
$5.00 MINIMUM SHIPPING - U.P.S. (IN U.S.)
Speak with amateur astronomers . . . ASK FOR GLENN-ARS: K3WEI, DON KD3LN, MIKE, STAN OR STEVE
Catalog: $6.00 (within U.S.) $9.00 to Canada $15.00 Elsewhere
Prices subject to change

No Surcharge on Credit Cards

DISCOVER NOVUS VISA MasterCard

WORLDWIDE SHIPPING
Price List send SASE w/58¢ in stamps

ASTRO NEWS

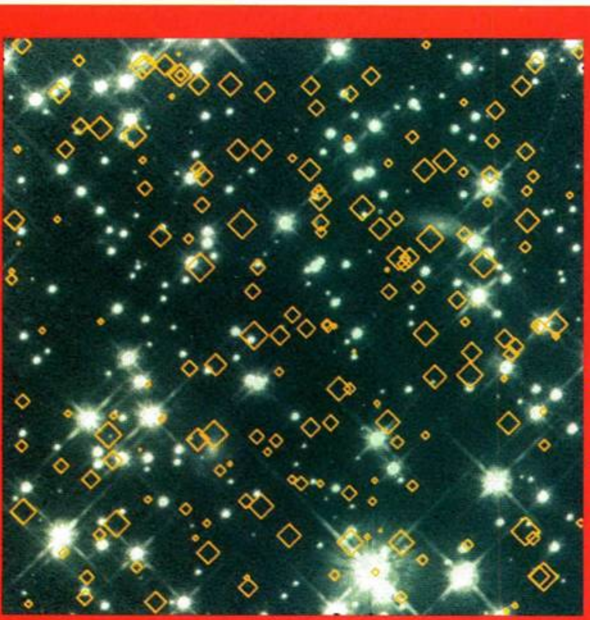
Red Dwarfs Can't Explain Dark Matter

Astronomers used to think faint red dwarf stars having roughly 10 percent the mass of the Sun or less were the most numerous stars in the Galaxy and that this abundance of very low-mass stars could account for much of the dark matter believed to make up at least 90 percent of the universe. Now two teams of astronomers working independently with the Hubble Space Telescope have shown such stars are, in fact, rare and have ruled out the possibility that they contribute significantly to dark matter.

"Our results increase the mystery of the missing mass. They rule out a popular but conservative interpretation of dark matter," says John Bahcall of the Institute for Advanced Study in Princeton, New Jersey. Large amounts of dark matter, so called because it emits little or no light, are needed to explain the motions of stars in galaxies and of galaxies in clusters.

Bahcall, along with Andrew Gould of Ohio State University and Chris Flynn and Sofia Kirhakos of the Institute for Advanced Study, reported in the November 1, 1994 *Astrophysical Journal Letters* on their search for red dwarfs in the halo of the Milky Way Galaxy. The general trend in the Galaxy is that small stars are far more plentiful than larger stars, which led many astronomers to think that enormous numbers of very small red dwarfs existed. Trying to observe these stars proved difficult, however, because Earth's turbulent atmosphere slightly blurs the light from the faint stars, making them indistinguishable from more distant, diffuse-looking galaxies. Hubble can observe red stars 100 times dimmer than those detectable from the ground and resolve them as points of light, making it easy to differentiate stars from galaxies. The Hubble observations show that red dwarfs with less than about 0.1 solar mass make up no more than 6 percent of the mass in the halo of the Galaxy and no more than 15 percent of the mass in the disk.

By coincidence, Francesco Paresce of the Space Telescope Science Institute in Baltimore, Maryland, and the European Space Agency, along with co-investigators Guido De Marchi of STScI and the University of Firenze, Italy, and Martino Romaniello of the



Francesco Paresce, STScI and ESA

WHERE ARE THE RED DWARFS? Hubble observed a small region (1.4 light-years across) of the globular cluster NGC 6397, a 6th-magnitude cluster located 7,000 light-years away in Ara. Astronomers expected to see 500 stars in the region (marked by diamonds). Instead they observed only 200, so few that they could see through the cluster and on to galaxies beyond. Astronomers don't know why the cluster contains so few red dwarfs, but will observe other clusters to compare results.

James Scotti, University of Arizona

HOUSE-SIZED ASTEROID 1994 XM_1 hurtles through Earth's neighborhood in this CCD image taken by James Scotti with the 18-inch Spacewatch telescope on Kitt Peak at 12:07 a.m. EST, December 9, 1994. The 43-foot asteroid was then about 330,000 miles away and 12 hours from its closest approach to Earth of 63,000 miles. The University of Arizona's Spacewatch asteroid discovery program found 1994 XM_1 only two hours earlier, when it was a 17th-magnitude streak in northwestern Cetus. The asteroid breaks a previous record for closest approach set in March 1994 when 1994 ES_1 *passed less than 96,000* miles from Earth.

SBIG
ASTRONOMICAL
INSTRUMENTS

NO MORE...

Guide telescopes! Off-axis radial guiders! Differential deflection! Searching for guide stars!

Introducing the Model ST-7 and ST-8 dual imaging cameras, the next step in the evolution of CCD camera technology. Each camera includes two CCD detectors: one for autoguiding and the other for collecting the image. They are mounted in close proximity, both focused at the same plane, allowing the imaging CCD to integrate while the PC uses the guiding CCD to correct the telescope.

Both imaging cameras utilize a Kodak CCD detector with 9 micron square pixels, plus on-chip binning to support 18 micron pixels for improved image quality with longer focal length telescopes. The Model ST-7 has a format of 768 X 512 pixels, and the Model ST-8 1536 X 1024 pixels. A high speed parallel interface is furnished allowing acquisition rates 20 times faster than a serial port.

SBIG has collaborated with Software Bisque to furnish a remarkable Windows software package that supports the camera functions, image processing functions, and the CFW-6A Color Filter Wheel. The Windows software is unsurpassed in performance and ease of operation.

M51 Whirlpool Galaxy: *The first galaxy found to have spiral structure is about 35 million light years distance and about 10 arcmin in apparent diameter. The entire spiral pattern is dominated by narrow dust lanes which can be traced deep into the nuclear region. The satellite galaxy evidently does not lie exactly in the plane of the big spiral, since dust lanes of the M51 arm can be seen crossing in front of it. Twenty minute Model ST-7 CCD image taken through an Astrophysics EDF, f/7 refractor through hazy skies. Post processed with TheSky astronomy software by Software Bisque. Courtesy Tony Hallas, Oakview, California.*

For catalog or demonstration disk contact

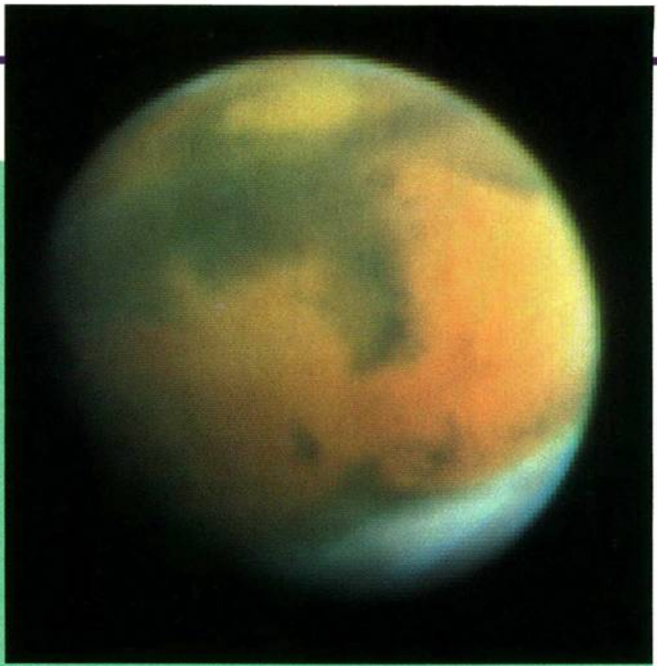
SBIG
ASTRONOMICAL
INSTRUMENTS

SANTA BARBARA INSTRUMENT GROUP
P.O. Box 50437 1482 East Valley Road #33
Santa Barbara, CA 93150
(805) 969-1851 FAX (805) 969-4069

University of Pisa, Italy, were searching for red dwarfs near the core of the globular cluster NGC 6397. Paresce's interest was piqued by a previous Hubble image of the cluster showing a core so devoid of stars that background galaxies appeared right through it.

The team found that stars with 20 percent the mass of the Sun were very common in the cluster (about 100 such stars for every star of the Sun's mass) but stars smaller than that were rare (*Astrophysical Journal*, February 1, 1995). "The very small stars simply don't exist," says Paresce. "There must be a mass limit below which the material is unstable and cannot make stars."

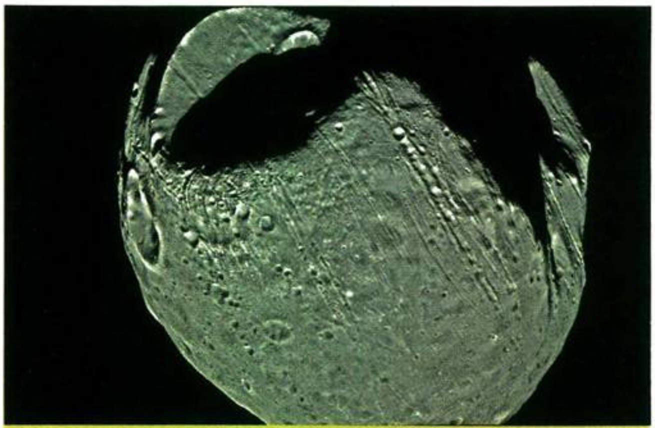
Paresce considered whether the very low-mass stars did form but were later thrown out after they interact with more massive stars in the cluster or when the cluster passed through the plane of the Galaxy. However, those cast-off stars presumably would be found in the galactic halo, and Bahcall's group didn't find them. As Bahcall stresses, "The dark matter problem remains one of the fundamental puzzles in physics and astronomy. Our results only sharpen the question What is the dark matter?"



SYRTIS MAJOR LOOMS LARGE in this image of Mars made with the Hubble Space Telescope on September 19, 1994. The image, made with the Wide Field/Planetary Camera 2, is a composite of blue (410 nm), green (502 nm), and red (673 nm) exposures centered on a longitude of 350°. The ruddy, T-shaped feature west of Syrtis Major had not been seen for months, suggesting the planet in September was relatively free of dust.

The north polar hood (bottom) is wispy, indicating the presence of a storm front. Clouds and a possible polar hood are also visible in the planet's south polar region (top). At the time the image was made Mars measured 5.6" across; images taken near opposition in February, when Mars was three times closer to Earth, will show about three times more detail. The image was made by a team consisting of Phil James, James F. Bell, Leonard Martin, R. Todd Clancy, and Steve Lee.

James F. Bell, NASA/HST



Damon Simonelli and Joseph Veverka, Cornell/NASA

A "CLEANED-UP" PHOBOS SHOWS SHARPER DETAILS after recent computer processing. Planetary scientists Damon Simonelli and Joseph Veverka of Cornell University used new techniques to mosaic three Viking 1 frames so well that the joints between the individual frames disappeared. They then processed the composite image to emphasize small surface details. The result is a "new" view of Mars' larger moon that shows craters and grooves much better. The enigmatic grooves may be fractures from the huge Stickney impact, whose 10-kilometer-wide crater is visible at upper left.

Research Supports Smaller Universe

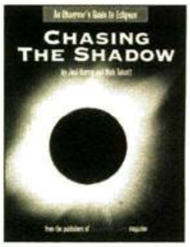
Over the past two years, astronomer Sidney van den Bergh of the Dominion Astrophysical Observatory in Canada has analyzed the results from observations of "standard candles" in galaxies using a variety of methods (see "Candles to Light the Night," September 1994).

Drawing on observations of type Ia supernovae, type II supernovae, the Tully-Fisher galaxy relation, surface brightness fluctuations in galaxies, planetary nebulae, and globular clusters, and on other methods of gauging distances to spirals and ellipticals, van den Bergh refined estimates of the distances to key galaxies and reported the findings in the November 1994 *Publications of the Astronomical Society of the Pacific*.

Factoring in such a wide range of methods allows van den Bergh to estimate the Hubble constant, a number by which astronomers measure the expansion rate of the universe, and therefore the size of the universe. "These new data appear to have shifted the balance of evidence towards shorter distance scales," says van den Bergh. He proposes a Hubble constant greater than 75 km/sec/Mpc, which agrees with the recent studies by research teams led by Wendy Freedman and Michael Pierce (see "How Far to Virgo?" March 1995).

In evaluating the different methods for determining a galaxy's distance, van den Bergh concluded that type Ia supernovae have too wide a range of luminosities to make them reliable as distance indicators. He also found that spiral galaxies of a given Hubble type and luminosity class have too large a range of diameters to be used reliably as distance indicators.

The most complete guide to observing solar eclipses.



Nine central solar eclipses will grace the world's skies during the 1990s. Discover how you can make the most of each one with *Chasing the Shadow*, from the publishers of ASTRONOMY.

This complete observing guide covers the best places, times and equipment for observing every solar eclipse during the decade. Practical observing information includes the three kinds of eclipses, recommended travel preparations, choosing an observing site, observation techniques, equipment, still and video photography and safety precautions. The benefits of studying the Sun during an eclipse and the effect eclipses have had on human history are also included. Get ready for the eclipses of the '90s! By Joel Harris & Richard Talcott. 7⅜ x 9¼; 160 pgs.; 48 photos and illustrations; 14 maps; softcover.

#18542..........$18.95

To order, call toll free 1-800-533-6644, 24 hours a day.

For faster service call Monday – Friday 8:30 am – 5:00 pm CT.
Please have your credit card ready.
Fax 414-796-1615. Outside the U.S. and Canada call 414-796-8776.

Send your order to Kalmbach Publishing Co., Dept. A0989, 21027 Crossroads Circle, P.O. Box 986, Waukesha, WI 53187-0986. Include for postage and handling: U.S. add $3.00 for 4th class (or $4.50 for UPS in the continental U.S. only), Canada add $5.00, other foreign add $10.00. Maryland and Wisconsin residents add 5% sales tax to total. Virginia residents add 4.5% sales tax to total. Canadian residents add 7% GST to total. Payable in U.S. funds. Prices and availability subject to change.

Dept. A0989

Meade®

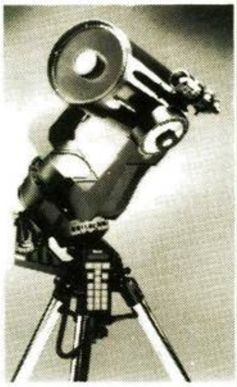
ADVANCED PRODUCTS

- SAME DAY SHIPPING
- NO EXTRA CHARGE FOR CREDIT CARDS
- FULL LINE OF MEADE ACCESSORIES

FOR ORDERS ONLY

1-800-359-5085

FOR PRODUCT INFORMATION
1-313-846-3922

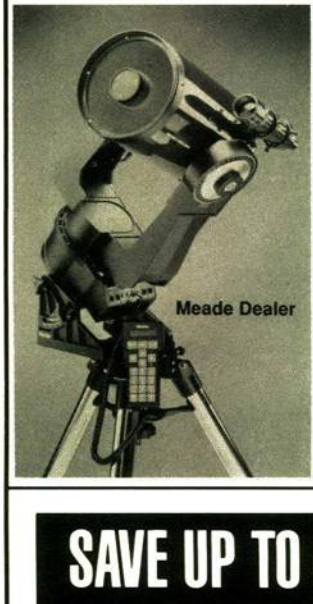


MEADE SERIES 4000
"Best Overall Performance"
Plossl test, *SKY & TELESCOPE* magazine

PRECISION OPTICS
CITY camera
15336 W. WARREN • DEARBORN, MICHIGAN 48126

Scope City

Largest, Most Complete Optical Supermarket in the World



Parks 10"
f/3.5 & f/13.5
Dual System
H.I.T. Telescope

Complete line of TeleVue products.

Complete line of refractors.

WORLD'S LARGEST SELECTION OF BINOCULARS

SAVE UP TO 45%

ON TELESCOPES, BINOCULARS & ACCESSORIES. EXPERT HELP.

See the latest innovation in astronomical equipment

MAIN OFFICE
679 Easy St.
Simi Valley, CA 93065
TEL: (805) 522-6646

SHERMAN OAKS, CA
14324 Ventura Blvd.
TEL: (818) 789-5805

SIMI VALLEY, CA
679 Easy St.
TEL: (805) 522-6646

SAN DIEGO, CA
4766 Clairemont
Mesa Blvd.
TEL: (619) 277-6686

COSTA MESA, CA
3033 S. Bristol
TEL: (714) 957-6900

SURPLUS STORE
COSTA MESA, CA
3033 S. Bristol
TEL: (714) 957-6900

SCOPE CITY / MAIL ORDER
P.O. Box 440 • Simi Valley, CA 93065
TEL: (805) 522-6670
FAX: (805) 582-0292
Catalog package $7 (refundable with purchase).
Free price list.

BUY • SELL • TRADE • SERVICE

A Less Dusty Galaxy?

The amount of dust in interstellar space may actually be far less than previously thought. Researchers studying the properties of one type of dust grain have found it to be six times darker than previously believed. To account for the amount of starlight being absorbed by the dust, this implies there should be six times less dust in space.

Albert Sievers, a physicist at Cornell University in Ithaca, New York, and his colleagues studied a mineral called forsterite, a pure magnesium form of olivine, in the laboratory. Forsterite is believed to be a principal component of interstellar dust. The researchers reported in the November 17, 1994 issue of *Nature* on the radiation emitted by the mineral in the wavelength range of 0.5 micrometer to 5 millimeters, where the cold dust grains (20 to 40 kelvins) radiate most of their energy.

"Everyone thought these grains were crystals," says Sievers, "but it turns out amorphous, glassy material has radiating properties much closer to what astronomers are observing." And in that form at interstellar temperatures, forsterite radiates six times less energy and so appears six times darker than thought. The researchers now plan to look at other common constituents of interstellar dust to see if they have similar properties. If so, the total mass of interstellar dust in the Galaxy should also be six times less than thought.

X rays Cast Doubt on Cold Dark Matter

X-ray observations made by the ROSAT satellite show that galaxy clusters clump together more than predicted by a leading theory. The results confirm previous optical studies of the clustering of galaxy clusters and reaffirm that it's time to revise the cold dark matter theory. This matter consists of slow-moving, massive particles that can gravitationally bind together to form seeds that subsequently draw in ordinary matter. In the early 1980s, theorists proposed cold dark matter as necessary to give structure to the universe after the Big Bang.

Katherine Romer of Northwestern University in Evanston, Illinois, and colleagues in Germany, the United Kingdom, and the United States used ROSAT to record X rays emanating from the hot intergalactic gas present in clusters. The new observations, reported in the

AMATEUR NEWS

A Party Under Enchanted Skies

Observers from 13 states converged on Socorro, New Mexico, September 30 to October 2, 1994, to inaugurate the Enchanted Skies Star Party, sponsored by the New Mexico Institute of Mining and Technology, the National Radio Astronomy Observatory, and the city of Socorro. Besides offering crisp New Mexico skies, the party featured a lineup of speakers and tours of NRAO's nearby Very Large Array radio telescope.

On Saturday, talks featured professional astronomers from NRAO, the University of Chicago, the University of New Mexico, New Mexico State University, and New Mexico Tech. They spoke on a variety of topics, including the Sun, galaxy dynamics, Comet Shoemaker-Levy 9's impact with Jupiter, large-scale structure in the universe, the role of astronomy in public education, and comets and the origin of life. Amateur astronomers who spoke included John Dobson, co-founder of the San Francisco Sidewalk Astronomers, and Barry Gordon, author of the book *Astrophotography*.

A Saturday night observing session let the public look through telescopes and talk with amateur astronomers. Earlier that evening awards were presented for the most innovative telescope (a pair of 17.5-inch binoculars) and the star party's best astronomical drawing (an excellent pencil drawing of Saturn).

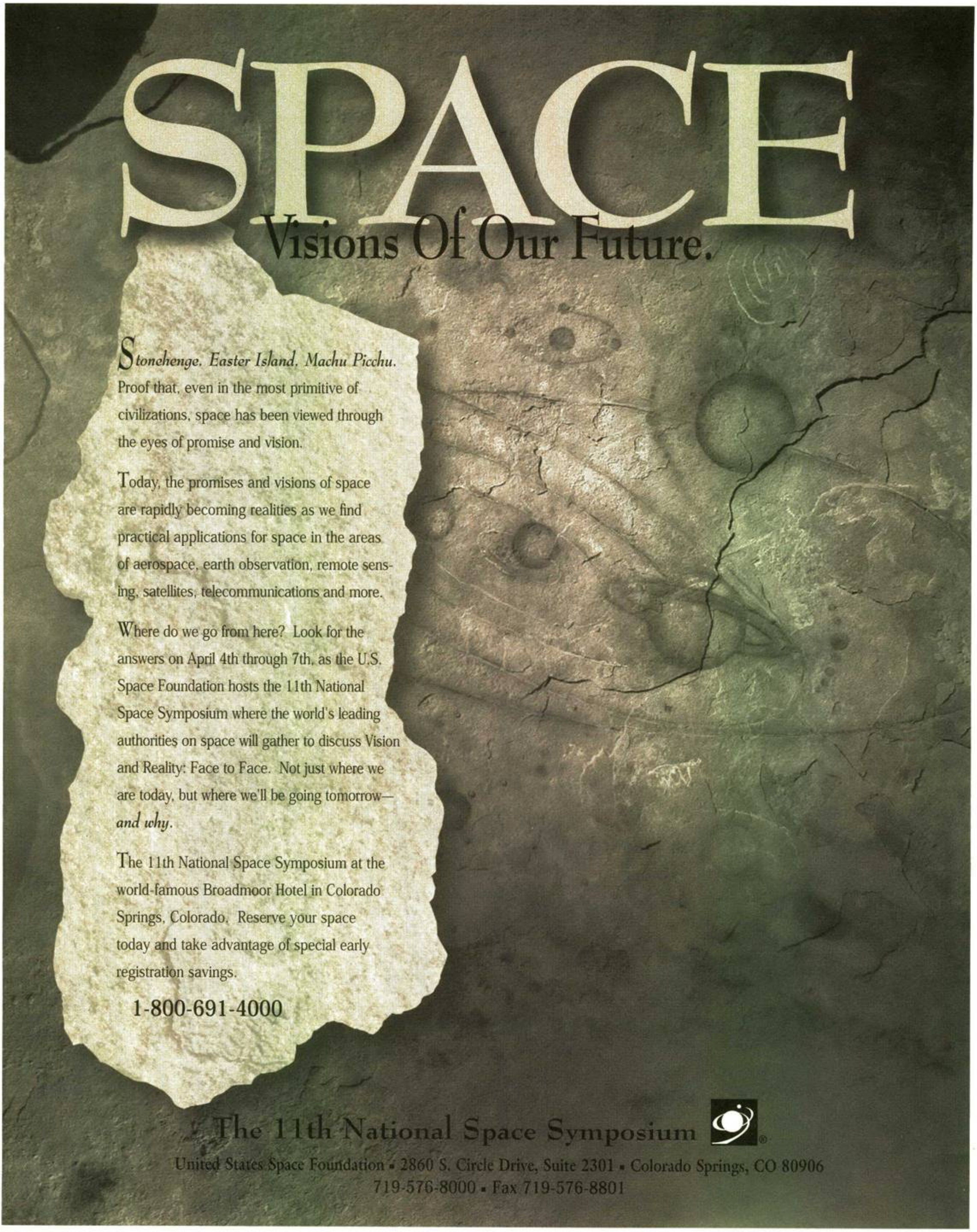
Enchanted Skies Star Party 1995 will be September 21 to 24. For more information, write Enchanted Skies Star Party, P.O. Box 743, Socorro, NM 87801, or call (505) 835-0424.
— David Finley

Celebrating Solid Gold Brass

What's it like to view Saturn and M15 through a really large and famous telescope? For people at the October 1994 meeting of the Antique Telescope Society, it was transfixing. They enjoyed a private tour and observing session with Lick Observatory's refractor, a 36-inch telescope with optics figured by Alvan Clark 107 years ago. This once-in-a-lifetime viewing opportunity was the grand finale of a four-day ATS meeting held at Santa Clara University in California.

But the ATS meeting had more to offer than a trip to a nearby observatory. A colorful history of how America took the lead in fielding large telescopes was brought to life by Donald E. Osterbrock, director emeritus of Lick Observatory. He spoke about the love/hate relationship between telescope builder George Ritchey and solar astronomer and observatory builder George Ellery Hale. The most memorable presentation came from retired Lick astronomer Gene Harlan, who demonstrated how he set up and used a turn-of-the-century spectrograph, the finest ever built by optician James Brashear, on Lick's big Clark refractor. The audience sat in a hush of anticipation. The feelings he eloquently expressed for a telescope he used to make 45,000 spectrograms touched everyone in the room. During intermissions, collectors from all over the United States showed off antique transits, binoculars, brass telescopes, and astronomical books.

For information about ATS membership and the October 1995 meeting in Philadelphia, expected to be the largest yet, contact Walt Breyer, 30 Green Valley Rd., Wallingford, PA 19086.
— Glenn Oclassen



SPACE

Visions Of Our Future.

Stonehenge. Easter Island. Machu Picchu. Proof that, even in the most primitive of civilizations, space has been viewed through the eyes of promise and vision.

Today, the promises and visions of space are rapidly becoming realities as we find practical applications for space in the areas of aerospace, earth observation, remote sensing, satellites, telecommunications and more.

Where do we go from here? Look for the answers on April 4th through 7th, as the U.S. Space Foundation hosts the 11th National Space Symposium where the world's leading authorities on space will gather to discuss Vision and Reality: Face to Face. Not just where we are today, but where we'll be going tomorrow—*and why*.

The 11th National Space Symposium at the world-famous Broadmoor Hotel in Colorado Springs, Colorado. Reserve your space today and take advantage of special early registration savings.

1-800-691-4000

The 11th National Space Symposium

United States Space Foundation • 2860 S. Circle Drive, Suite 2301 • Colorado Springs, CO 80906
719-576-8000 • Fax 719-576-8801

November 3, 1994 issue of *Nature*, provide the most comprehensive look yet at galaxy clusters, recording them three times farther away than previous optical surveys such as the widely used *Abell Optical Cluster Catalogue.*

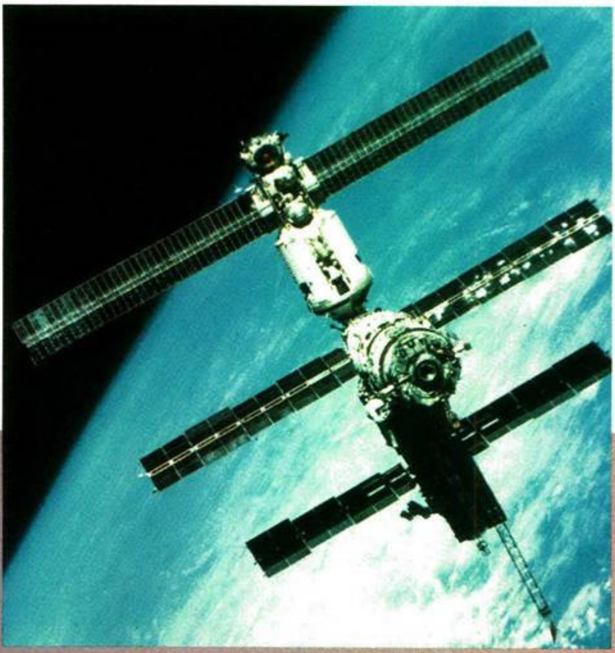
The researchers scrutinized X rays from well over 100 clusters in a small region of sky. They then compared the cluster locations with locations produced theoretically when only cold dark matter was present. They found that the tight clumping observed could only come about if some other material, in addition to cold dark matter, was at work. Some theorists think hot dark matter (faster moving cousins of cold dark matter, such as neutrinos) may be the missing ingredient.

The Most Distant Galaxy Known

A team of astronomers from the United Kingdom, the Netherlands, and the United States, has discovered the most distant galaxy known. Designated 8C 1435+635, the object is a radio galaxy with a redshift of 4.25 corresponding to a motion away from Earth of nearly 280,000 km/sec, or 93 percent the speed of light. Depending on the assumptions astronomers make, this places the galaxy somewhere between 8 and 12 billion light-years away. The only objects more distant than this are quasars, the most remote having a redshift of 4.9.

A cast of many astronomers from Oxford University, Leiden University, Cambridge University, the Space Telescope Science Institute, Manchester University, the Royal Greenwich Observatory, and the Massachusetts Institute of Technology discovered the galaxy with the Very Large Array radio telescope in New Mexico. They then used the 4.2-meter William Herschel telescope in the Canary Islands to take its spectrum, and published the result in the November 15, 1994 issue of the *Monthly Notices of the Royal Astronomical Society.*

Subsequent observations with the 10-meter Keck telescope in Hawaii confirmed



NPO-Energia

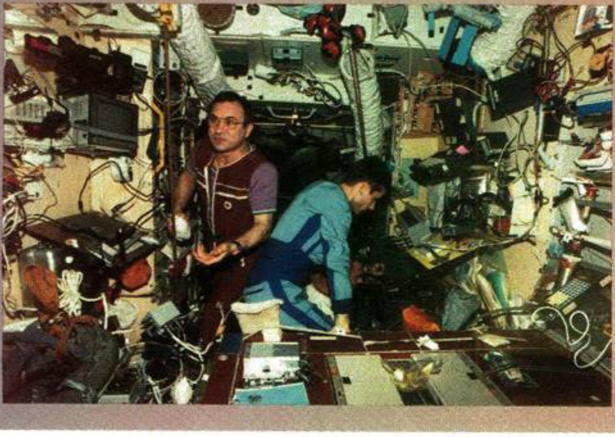
THE MIR SPACE STATION (above) orbits 240 miles above the Earth, shot during EUROMIR '94, a cooperative space mission between the European Space Agency and Russia in October 1994. Two modules, a Kvant 2 astrophysics experiment (dark module at bottom of image) and a Kristall material processing/biotechnology facility (white module above center of image), are connected to one end of the orbiting space station.

Americans Get the Mir Experience

If all goes according to plan, NASA astronaut Norman Thagard blasts off March 19 on a Soyuz rocket with Russian cosmonauts Vladimir Dezhurov and Gennadiy Strekalov to the Russian Mir space station. There they will start a 3-month tour with three cosmonauts already on the station. Thagard will conduct a variety of medical experiments on Valeri Polyakov, launched into space on January 8, 1994, and Aleksandr Vicktorenko and Elena Konakova, both on Mir since November 3, 1994. This will be the first data collected by Americans on the effects of long duration spaceflight since Skylab missions were flown more than 20 years ago.

Some time in late May or early June, space shuttle Atlantis will dock with Mir for five days before returning to the Earth with Thagard, Dezhurov, and Strekalov. Two cosmonauts delivered to the station by Atlantis, Anatoly Solovyev and Nikolai Buradin, will remain on board Mir. Later this year, Atlantis will rendezvous again with the space station, this time to install a new module that allows for routine docking of shuttles.

The Russian Mir space station, launched in February 1986, is 43 feet long and 14 feet wide and sports solar panels that span 98 feet. It supports up to six crewmembers for short periods and, with monthly deliveries of food, fuel, and oxygen from unmanned Progress resupply flights, it can support two people indefinitely (current record: 15 months). Life in space is a chore, however: With six people, the station interior gets quite cramped, as can be seen in the photo at left taken during October 1994's visit by European Space Agency astronaut Ulf Merbold.



ESA

Simply the world's brightest

Using patented EBC multicoatings and exclusive glass formulations, Fujinon Polaris binoculars give you better than 95% light transmission for *the brightest viewing ever!*

Unique flat-field optical design assures virtually no distortion or astigmatism and increases the useful field area more than 40% by eliminating defocused star images near the field stop. The result is the widest, sharpest and brightest contrast views of globular clusters, galaxies and delicate nebulae detail. Polaris models provide outstanding balance and ultra-long eye relief for viewing comfort. They're waterproof, meet US Mil Specs, and are backed by Fujinon's lifetime limited warranty.

Polaris models: 7x50 FMT-SX, 10x70 FMT-SX and 16x70 FMT-SX. Options include a tripod adapter and filters. Fujinon also offers the incredible 40x150 EDMT-SX, 25x150 EM-SX (with 45° angle viewing) and 25x150 EDMT-SX.

For more information, contact:

25 x 150 EM-SX

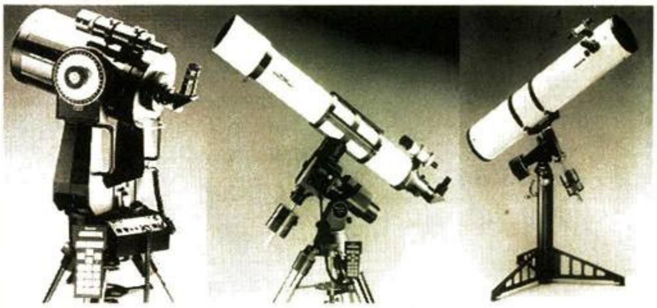
FUJINON INC.
10 High Point Drive,
Wayne, N.J.07470
(201)-633-5600

In Hawaii: Fuji Photo Film Hawaii, Inc. (808) 942-9400
In Canada: Fuji Photo Film Canada, Inc. (416) 890-6611

FUJINON

Meade

ADVANCED PRODUCTS



For Pricing, Call:

818-505-8424

California Telescope Company

P.O. Box 1338, Burbank, California 91507
MasterCard, VISA, DiscoverCard

NEW!

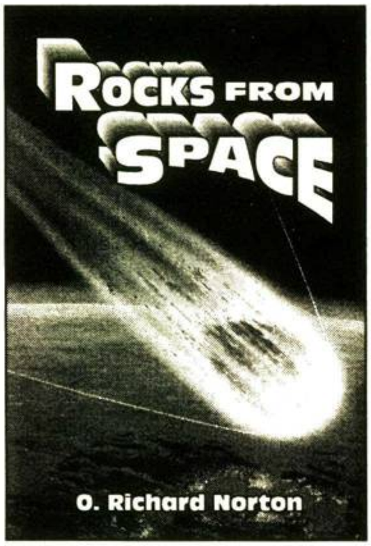
Rocks from Space

Meteorites and Meteorite Hunters

O. Richard Norton
Illustrated by Dorothy Sigler Norton

To hold in your hand a piece of the solar system, a rock from space older than Earth itself—this is the allure of the meteorite. Hurtling through space from points unknown, these thunderstones crash-land on Earth and then remain to be found by rockhounds. *Rocks from Space*—for the rock collector, the stargazer, or the inquiring layperson—is the first nontechnical guide to the fascinating world of meteorites, asteroids, and comets. *Rocks from Space* tells the story of cosmic debris—the science, the superstition and folklore, and the tales of people who collect them.

464 pages • 6x9
over 200 photographs and illustrations, 33 in color
ISBN 0-87842-302-8 • paper $20.00 + $3.00 postage/handling



Mountain Press Publishing Company
P. O. Box 2399 • Missoula, Montana 59806
(406) 728-1900 • Fax (406) 728-1635

Call Today for a
FREE CATALOG
Toll Free
1-800-234-5308
Available 24 Hours

its large distance. Over time, studies of such extremely distant galaxies may enlighten astronomers about conditions in the early universe.

Unexpected Signals from Jupiter

Radio astronomers expected radio emissions at high frequencies to drop when Comet Shoemaker-Levy 9 crashed into Jupiter in July 1994. Instead, Mike Klein of the Jet Propulsion Laboratory in Pasadena, California, found emissions increased by 20 to 30 percent at a frequency of 2.3 gigahertz.

Astronomers thought dust kicked off the comet fragments would absorb the electrons spiraling around Jupiter's magnetic field that cause the radio waves. But apparently the dust somehow created extra electrons that intensified the radiation through an as yet unknown mechanism.

Expected outbursts at lower radio frequencies didn't materialize, so the dust apparently didn't encounter in a dramatic way the cloud of charged particles surrounding the satellite Io.

Moon Reveals New Stars

Occasionally the Moon passes in front of a star. When the edge of the Moon blocks the light of the star, astronomers can search the immediate vicinity to locate previously unknown stars normally hidden in the glare of the now occulted star.

Andrea Richichi of the Max-Planck-Institut für Astronomie in Heidelberg and colleagues used this technique to uncover seven new binary stars in Taurus and Gemini. Researchers long suspected that one of these, Taygeta in the Pleiades, was a binary and the new observations confirm their suspicions. The other stars don't have common names because they are too faint, but their Henry Draper catalog numbers are 30945, 31294, 39184, 41061, 44653, and 46467.

The astronomers reported their discoveries, made with the 1.5-meter scope on Gornergrat in Switzerland and the 3.5-meter telescope on Calar Alto in Spain, in the June (III) 1994 *Astronomy and Astrophysics*.

Attention Night Visioneers!

Some night-vision instruments manufactured in Russia and Belarus employ near-infrared illuminators that emit low-energy X rays or use laser diodes that exceed safety limits set by the Food and Drug Administration.

According to the Spring 1994 *Radiological Health Bulletin* published by the FDA, three units tested used laser diodes that could pose an optical hazard if viewed directly. They are Models NP-1 and NZT-4, produced by the Opto-Mechanicheskij Zavod in Rostov, Russia, and Model SM-4a "Cheetah," made by the Byelorussian Optical Mechanical Amalgamation, Minsk, Belarus.

In addition, the T3C-2 and T3C-3 viewers made by the Novosibirsk Instrument Making Plant, Novosibirsk, Russia, emitted low-energy X rays at levels of up to 20 millirads per hour. The FDA limits for similar devices, such as television sets, is 0.5 millirad/hour.

Orion Telescope Center's Tim Gieseler, whose company markets T3C viewers, works closely with the FDA and importers to make sure that units he sells pose no risk.

"Viewers the FDA tested were not manufactured to stricter U.S. standards. Models we import have additional shielding or use newer technology to eliminate X-ray emissions," he says. According to the FDA, viewers that use laser diodes must have a label that provides both the name and address of the manufacturer and states whether they meet federal safety standards.

An Early Look at the Cosmic Background Radiation

The fireball of the Big Bang created a cloud of energy that has diffused as the universe has expanded. The temperature of the radiation has dropped from its original incomprehensible value to a mere 2.7 kelvins today. Big bang cosmologies predict how the temperature changed with time.

To test these predictions, Antoinette Songaila of the Institute for Astronomy in Hawaii and her coworkers measured the temperature of the background radiation at a time corresponding to 4 billion years after the Big Bang.

Using the 10-meter Keck telescope in Hawaii, they detected a dark spectral line produced by carbon atoms in a cloud absorbing light from the cosmic background radiation. The cloud, about 11.8 billion light-years distant, lies near the quasar Q 1331+170 in the sky.

Theories predict a temperature of 7.58 K for the background radiation at 4 billion years after the Big Bang. The astronomers' analysis of the spectral line from the absorbing cloud indicates a temperature of 7.4 K, confirming the prediction within the errors of the measurement. Details of this study can be found in the September 1, 1994 issue of *Nature*.

European Southern Observatory

PLUTO'S FAMILY HAS GAINED another member, a distant asteroid named 1994 TG_2. Olivier Hainaut of the European Southern Observatory discovered it in October 1994 using the 3.5-meter New Technology Telescope. The asteroid lies about 42 astronomical units from the Sun (1 AU is the average distance between the Sun and Earth), and joins 16 other objects in orbits beyond Neptune. Nine of the objects have orbital radii of 31 to 36 AU; the others have radii of 40 to 45 AU. Neptune's gravity may cause the gap.

With a diameter of 100 to 200 kilometers, 1994 TG_2 shines feebly at 24th magnitude. At the time of discovery, the object was moving along the border of Pisces and Aquarius. Astronomers continue to debate the nature of these objects, whether they are comets or asteroids, and how they relate to Pluto and its satellite Charon.

★ ★ ★ BEST VALUES - LOWEST PRICES! ★ ★ TELRAD ★ PARKS ★ BUSHNELL ★ RIGEL SYSTEMS ★ SCORPIUS ★ ASTRO SYSTEMS ★ SKY PUBLISHING ★ ★ ★

★ ★ ★ ★ WE HAVE IT ALL ★ ★ ★ ★ ★ (203) 746-3579 ★ 10 AM TO 10 PM ★ 7 DAYS A WEEK ★ TELEPHONE ORDER LINES ★ WE HAVE EVERYTHING AT WHOLESALE OPTICS ★ TRADE-INS CONSIDERED ★ ★ ★

SELSI ★ LOSMANDY ★ VIXEN ★ TASCO ★ EWA ★ DELTA BRAND ★ NIKON ★ EDMUND ★ SWIFT ★ 1000 OAKS ★ AULERBLICK ★ STEINER ★ J.M.I. ★ DAVIS & SANFORD ★ TIFFEN ★ VOGEL/DIGITRACK ★ JASON ★ UNIVERSITY OPTICS ★

NEW EQ. MOUNT for DOBS $395. (6 TO 10 INCH)

LOWEST GUARANTEED LISTED PRICES!

NEW C8-C11 ULTIMA 2000 COMPUTER - GO TO TELESCOPE - CALL

NOW AVAILABLE

EQ. MOUNT GM 8-A $1249 COMPLETE

SEE MEADE AD

Authorized Meade Dealer

WE ARE A FULL LINE MEADE DISTRIBUTOR

SEVEN DAYS A WEEK 10 to 10

CELESTRON $AVE

NOTICE: LOWER PRICE FOUND? JUST GIVE A CALL!
SPECIAL 25mm 1 1/4" EYEPIECE $25 EACH!

TELESCOPES SCH/CASS.
C5, (AC/DC) **C8** Classic,
GPC8, **C8** + Computerized,
C8+, Ultima C8, C8/11 2000
CG11, **C14**, **C14** Computerized .... **Lowest Prices**

LATEST MODELS WITH CROWN GLASS IN STOCK

TELESCOPES REFLECTORS
C4.5, 7.9" f4(RFT) .... Call For **BEST Price!**

TELESCOPES REFRACTORS
First Scope 80, 60, 90F, GP 102, GP102 ED, GP102F

SPOTTING SCOPES
C90 all models, S50, C60RC, 20x60 WP, 20x60 Ed-WP, 30x60 WP, S80, S80+, C5, C8, 500Mmm. f5.6 .... **CALL**

BINOCULARS - PRICED TO SELL!
Monoculars 5x20, 8x25, 6X16 — **UNBEATABLE**
Mini 8x25, 8x22, 10x25, 8x24PP, 10x24PP — **PRICES**
NATURE 7X35, 7X50, 8X42
Pro 8x30, 7x50, 10x50, 12x50, 8x56, 9x63, 8-24x50 Zoom
ULTIMA 8x32, 7x42, 10x42, 7x50, 10x50, 8x56,
ED SERIES 6.5x44, 9.5x44
Water Proof 8x21, 8x30, 12X80mm
Giant 16x70, 11x80, 15x80, 20x80, 20x100 mm, ... **CALL**

OPTICAL TUBE ASSEMBLIES

C8" Optical Tube Assem. Star Bgt.	$695
GP 102........$595, C11......CALL, C14	$3999

ULTIMA EYEPIECES

5, 7.5 12.5 mm	ea $70
18mm, 24mm, Ultima 1 1/4"	ea $74
30........$87, 35........$103, 42mm	$99
45 60mm 2" 80mm	CALL
OR 6, 7, 9, 12mm (96")	ea $35
KE 10mm 16, 18 25 30 40 (96")	ea $30

PLOSSL OCULARS **NEW CELESTRON SERIES**

1 1/4" 7.5, 10, 17, 26mm...$46 .. 40mm PL...	$54
(.96) 7.5, 10, 17, 26mm PL...	$42
Zoom 6.5-18, 1 1/4" ORTHO.	$113
25mm K 1 1/4" Multi-Coated	$25
4,5,6,12 Ortho (Multi-Coated) 1 1/4"	ea $49
18 25mm 2" SPECIAL PURCHASE	ea $74

REVOLUTIONARY LANTHANUM EYEPIECES -LV SERIES - STATE OF THE ART - RARE EARTH GLASS -

2.5 mm, 4mm, 20MM, 25MM, 1 1/4"	$102
5mm, 6mm, 9mm, 10mm, 15mm.....$95, 30mm., 2" ...	$130
Coma Corrector Photo-Visual 1 1/4" - 2"	$165
Micro Guide Eyepiece	$145
6mm ILLUM-Reticle 1 1/4"	$154
Adapter 2" to 1 1/4"	$13

T-RINGS

(State Camera Make Model) All	$10 EA

ACCESSORIES

AC Adapter (PEC)	$21
Accessory Case -DELUXE-	$43
Barlow Lens 2x96".(Deluxe).....$24, 2.5 x (.96)	$24
Barlow Lens 1 1/4" Short type (NEW)	$53
Barlow 2 x Ultima	**BEST Price!**
Barlow 3 x 1 1/4"	$39
Barlow Lens 2x2" m/c (Giant)	$69
Battery XP14 (For Finder - ILL.RET.)	$8
Binocular Tripod Adapter	$14
Car Batt. Adapter Ultima (PEC)	ea $19
Car Window Mount	$29
Carrying Case - Powerstar 8 Custom ULTIMA	$138
Counterweight Bar Assem -8" .... $58 11"	$63
Counterweight Set - 8" (Standard) $48, C5	$55
DC Inverter (110V) (DGT II)	$73
Drag Erect Image - 45° 96" .... $42 45° 1 1/4"	$41
45° 96" to 1 1/4" DIAGONAL	$43
DEC Motor (PEC) 8/11, Ultima-Powerstar, Classic 8	$99
DEC Motor C4.5 and SP MT (DC)	$59
Deluxe Lat Adjuster (DLA) C8	$30
Dewstar (Lens Shade - 8")	$24
Advanced Astro Master	$309
Drive Corrector - Heavy Duty	$358
Drive C8 Quartz Sing Axis (C8 - Classic)	$195
Expanding Bushing - 96" to 1 1/4"	$13
Filter (All Colors) 2" (Eyepiece)	ea $19
Filters #1A 8 12 15 21 23A 25 38A 47 56 58 80A 82A 96ND 50% 96ND 25% 96ND 13% Polarizer 1 1/4"	ea $10
Filter Sets (Set of 6) .... $59 (Set of 12) ..	$108
Filter - Series 5 or 6 (6 ea. in Set)	$49
Filter Adapter - 96" .... $11 1 1/4"	$15
Finderscope 8x20 for C90-erect image....$54 BKT	$12
Finderscope 5x24 STG ...$29 6x30	$39
Finder Bracket (Quick Release) 8X50	$45
7x50 III POLAR AXIS Finder	$135
Focus Motor - C8, Classic 8, PWR STAR	$105
Image Corrector - .96 18mm Eyepiece	$15
Large Accessory Ring (LAR) C90	$21
LED Flashlight	$13
Lens Shade - C90......$53, C5....$48, C8......	$24
LPR Filter(Nebular #2.....$129, #5	$79
#7.....$89, "A"....$54, "B"...$79, C"...$75, "D".(Bin.)....	$83
Motor Drive-for C4.5 w/Dr Single Ax.(DC)	$182
Motor Drive S A (AC) Pol/Sp C4.5, SPC6, SPC8	$88
Motor Drive w/Dr. Dual Axis SP (DC) & GP	$248
Multiple Ocular Holder 96".....$62, 1 1/4	$119
MFFT 55 (Multi function focus-tester)	$133
Photo Tripod Adapter 8" (Opt Tube)	$50
Photographic Tripod Deluxe Slow Motion Controls	$39
Piggyback Mount 8"........$31, C5.....$55 11 14 ...	$54
Piggyback Mount SPC 80 SPC6, SPC 102	ea $21
Polar Axis Finder w/Illum (for C4.5, C6, C80 SP)	$70
Polarizer Set (.96) (Variable)	$31
Polarizing Filter Set - 1 1/4" (Variable)	$42
Porro Prism - 965.....	$35
Radial Guide Assy Off Axis	$110
RFA (Rich Field Adap) f5	$89
Refractor Accessory Ring	$18
Reducer/Corrector Lens f6.3	$113
Reducing Bushing = 1 1/4" to 96"	$15
Filter Set - Series 5 (six) .... $49 Series 6 (six)	$57
Skylight Filter Dust Seal (5/8/11/14)	$34
Solar Filter - C90 C102 C4.5.....$63, C5	$70
5" Off Axis - C11.....$109, C8.....$98 C60 C80	$38
Sky sensor computer (SP-GP) Motors (Two)	$113
Star Diagonal (.96) .....$21, Star Diagonal 1 1/4"	$38
Star Diagonal 1 1/4" w/Multicoatings	$44
Star Diagonal (Mirror) 2" Deluxe Adjustable (PRO)	$218
Star Diagonal 2" (Mirror)	$120
Stereo Binocular Viewer	$449
Super Polaris Half Pier + (GP)	$112
GREAT Polaris Mt & Tripod with Finder..	$679
T-Adapter C90, C5, C8, C11, C14	ea $22
T-Adapter - C90........$29, S-80	$24
T-C 16mm Adapter	$28
Spotting Scope Tripod........$94, Mini Tripod	$28
Tele Extender- Deluxe.....$42, Tele Extender	$22
TeleExtender- Refractor-Newtonian	$50
ALT. EZT. MOUNT TRIPOD	$269
Tripod - Adjustable C5, C8.....$219 mini	$27
C8 Tripod (Oak) $195 11/14	$468
VSP (Vibration Suppression Pads)	$38
Visual Back - 1 1/4" (Eyepiece holder)	$26
Wedge - C8.....$85 11/14	$368
Wedge UII (Heavy Duty)	$359

PUBLICATIONS - BOOKS

Owners Manuals, Acc. Catalog	ea $9
Binocular Buyers Guide Book by Alan Hale	$6
Sky Maps..........	$11

MISCELLANEOUS

Lens Caps........ea 50¢ Accessory Tray (TRIPOD)	$29
f4 Reducer lens (for 500mm telephoto)	$83
4" Maksutov f10 1000mm	$349

BAUSCH & LOMB

(INTERNATIONAL DEALERSHIPS AVAILABLE)
Binoculars • S. Scopes • Wholesale +
BAUSCH & LOMB ACCESSORIES

PROFESSIONAL SERIES PL OCULARS 26mm...$49/ A.S.PLOSSL /12.mm...$39ea / 6mm OR...$45/ ZOOM ORTHO 8 to-21mm...$79/50mm RAM...$29 FILTERS SERIES 6 DROP-IN SET (6)..$49 WITH CASE/EYEPIECE ADAPTER..$49/RFT ASSY ..$89 4X FINDER (4000)..$29/ MEASURING RETICLE EYEPIECE..$79/ PIGGYBACKMOUNT(4")...$21/(6"&8")..$29/ DYNATRACK AC/DC DRIVE CORRECTOR ...$129./TRIPOD...6000/8000.....$159/MOTOR DRIVE (110 OR 220V)....$49/TELESCOPE...$749/6000A 6"SCH/CASS

LATEST 1995 MODELS

NEW MAK 9 & 10 INCH
6" MAK-INTES f10...$729

CELESTRON 12V Battery Pack + Recharger 7 AMP...$63 12 AMP...$73

CELESTRON BINOCULARS

7X42 Ultima	$185	7x50 Ultima	$244
8X32 Ultima	$181	8x56 Ultima	$274
10x42 WA Ultima	$221	10x50 Ultima	$254
11x80MC	$272	15x80MC	$315
20x80MC	$324	9x63 Pro	$199

NEW CG14 S/C NOW AVAILABLE

IMPORT - EXPORT

A WORLD CLASS DISTRIBUTOR TO INDUSTRY - GOVERNMENT-PRIVATE AND PUBLIC EDUCATIONAL INSTITUTIONS.

RETAIL ACCOUNTS

TELEPHOTO SPOTTING SCOPE 500mm f 5.6 KIT $289

★ ★ ★ OFFICIAL ★ MEADE ★ CELESTRON ★ B&L ★ AUTHORIZED DISTRIBUTORS

MEADE APD

THE "COMPLETE" LINE IS DISTRIBUTED AND LISTED

Standard 8"-10" Schmidt-Cassegrain Telescopes: ★ 2080A 8" f/10 ★ 2080B 8" f/10 w/Spr. Multi-Coatings ★ 2120A 10" f/10 ★ 2120B 10" f/10 Spr. Multi-Coatings **8"-10"-12" & 16" LX100 and LX200 SC Telescopes:** ★ 8" LX100 w/ f/10 ★ 8" LX100 w/ f/6.3 ★ 10" LX100 w/ f/10 (includes Spr.wedge) ★ 10" LX100 w/ f/6.3 (includes Spr.wedge) ★ 8" LX200 w/ f/10 ★ 8" LX200 w/ f/6.3 ★ 10" LX200 w/f/10 ★ 10" LX200 w/ f/6.3 ★ 12" LX200 w/f/10 ★ 16" LX200 w f/10 ★ Eq. Wedge 4", 8", 10", 12", 16" ★ Spr.giant fld. Tripod ★ 16" Perm. Altazimuth Pier ★ 16" Perm. Eq. Pier ★ 2045D 4" f10 S/C Tripod & Wedge (High-Low Latitude Leg Wedge only) w/carry case **SCT Acc.:** ★ Accessory Shelf ★ **Optical Tube Assemblies:** ★ 8" f/10 or f/6.3 OTA w/ EMC ★ 10" f/10 or f/6.3 OTA w/ EMC ★ 12" f/10 OTA w/ EMC ★ 16" f/10 OTA w/ EMC **STARFINDER 6"-8"-10"-12.5"&16" Eq. & Dobsonian Reflecting Telescopes:** ★ Starfinder Eq. 6, 6" f/8 ★ Starfinder Dobsonian 6, 6" f/8 ★ **STARFINDER Acc.:** ★ #43 Dr. Corr./Inv. for Starfinder EQ 6,8,10,16 ★ #65RS Man. Dec. Cont. for EQ 16 ★ #55 Man. Dec. Cont. for EQ 6,8,10 ★ #47M Dual-Ax. Dr. Corr. for EQ 6,8,10 ★ #48RS Dual-Ax. Dr. Corr. for EQ 16 ★ Basic camera adpt. (1.25") for all EQ mod. ★ Var. Proj. Camera Adp. (1.25") for all EQ mod. ★ #868 Ex. Tube (2") for EQ 16 ★ Accessory shelf for EQ 6,8,10, 16 ★ Vinyl Dust Cover for EQ or DOB 6", 8", 10", 16" **Mod. 227,285,390,395,4500 Refracting Telescopes:** ★ 227, 60mm (2.4") Altazimuth ★ 285, 60mm (2.4") Eq. ★ 390, 90mm (3.5") Altazimuth ★ 395, 90mm (3.5") Eq. ★ 4500, 114mm (4.5") f/8 Eq. Reflector **4", 5" 6", 7" *ED* Apochromatic Ref.:** ★ 4" Model 102ED ★ 5" Model 127ED ★ 6" Model 152ED ★ 7" Model 178ED ***ED/APO* Optical Tube Assemblies (OTA's):** ★ 4" Model 102ED OTA ★ 5" Model 127ED OTA ★ 6" Model 152ED OTA ★ 7" Model 178ED OTA **Acc. for *ED/APO* Ref.:** ★ #1664 Elec. Dr. Sys (EDS) ★ #1697 Computer Dr. Sys (CDS) ★ #1812 Elec. DC Adap ★ #814 Polar Align. finder ★ Univer. thread adap (UTA) ★ Cradle Ring Ass. 4", 5", 6", 7" ★ Basic Tele-Extender ★ Variabel Tele-Extender ★ #62 T-Adpt. ★ Eyepiece Holder (1.25") ★ Off-Ax. Guider ★ f/6.3 Focal Reducer/Fld. Flat. (4 ele, 41mm dia.) ★ Library #1: 10,600 objects ★ Library #2: 64,350 objects ★ AstroSearch/200 Sky Software ★ #905 Var. Pol. Flt. (1.25") ★ #1222 Fld. De-Rotater ★ #1205/1206 Elec. Focuser ★ #39S Dec. Motor ★ #43 Dr. Corr./Inv. ★ #46 Dual-Ax Dr. Corr. ★ #1812/1812A Elec. DC Adap. ★ #18110 AC Adap. ★ #1401 Tube Bal. Wgt. Sys. for 8" SCT ★ #1402 Tube Bal. Wgt. Sys. for 10" SCT ★ #1403 Tube Bal. Wgt. Sys. for 12" SCT ★ #1404 Tube Bal. Wgt. Sys. for 16" SCT ★ Ex. 2 lb Wgt. for all TBS's ★ #608 Dew Shield for 8" SCT ★ #610 Dew Shield for 10" LX200 ★ #612 Dew Shield for 12" SCT ★ #620 Dew Shield for 16" LX200 ★ 10" Equat. Wedge - 10" SCT ★ Std. Fld. Tripod - 8" & 10" LX200 ★ Giant Fld. Tripod - 12" LX200 ★ #531 Elec. Motor Dr. (4.4v DC) for Mod.s 285, 395, 4500 ★ #126 2x Short-Foc. Barlow Lens (1.25") ★ Basic Cam. Adp. (1.25"), for 390,395,4500 ★ #924 Erect-Im. Porro Pr. (1.25") for 390,395 ★ #928 45° Erect.-Iimg. Prism (1.25"/.965") for 390,395 ★ #931 45° Hy, Erect. Prism (1.25"/.965") for 227,285 ★ #917 90° Hy, Diag. Prism (1.25"/.965") for 227,285 ★ AD-1 adpt. (accepts .965" oc., fits 1.25" foc.) ★ AD-2 adpt. (accepts 1.25" oc., fits .965" foc.) ★ 50 Accessory Case (20"x12"x6.5") **PICTOR SERIES CCD Autoguider/Imagers:** ★ Autoglider 201 ★ Autoglider/Imager 208, 216, 416, 1616 **Auxiliary Sys. and Acc. for PICTOR CCD:** ★ #616 Color Filt. Sys. for 216,416,1616 ★ #505 Vid. Card/Floppy Disc Dr. for 416,1616 ★ #520 Elec. Rely for 201,208, 216,416,1616 ★ #541 AC adap. for 201,208,216 ★ #542 AC adap. for 416,1616 ★ Alt. 1.25" barrel ★ Alt. 2" or .965" (24.5mm) barrel ★ Special T-Adap. for CCD **Genuine MEADE Acc.:** ★ Series 4000 Eyepieces ★ Spr. Plo. 6.4mm, 9.7mm, 12.4mm, 15mm, 20mm, 26mm, 32mm, 40mm (1.25"), 56mm (2") ★ SWA 13.8mm, 18mm, 24.5mm, 40mm (2") ★ UWA 4.7mm, 6.7mm, 8.8mm, 14mm ★ #140 2x Apoch. Barlow Lens (1.25") ★ Series 3000 Plossl Eyepieces (1.25"): 5mm, 6.7mm, 9.5mm, 16mm, 25mm, 40mm ★ **Modified Achromatic Eyepieces (1.25" & .965"):** ★ 9mm ★ 12mm ★ 25mm ★ 40mm **Barlow Lenses (1.25" & .965"):** ★ #122 2X Telenegative (1.25") ★ #126 2X Short-focus (1.25") ★ #127 2X-3X Var. (1.25") ★ #134 2X Achromatic (.965") **Basic and Var. Proj. Camera Adpt.:** ★ Basic (.965") ★ Basic (1.25") ★ Var. Proj. (1.25") **T-Mounts (T-Rings) for:** ★ Canon ★ EOS ★ Contax ★ Fujica X ★ Konica ★ Minolta ★ Maxxum ★ Nikon ★ Olympus ★ Pentax (thread & K) ★ Petri **Schmidt-Cassegrain Photographic Adpt.:** ★ #62 T-Adpt. ★ Basic Tele-Extender ★ Var. Tele-Ext. ★ Off-Ax. guider and f/6.3 Focal Reducer/Fld. Flattener **Illuminated Reticle Eyepiece Sys.:** ★ Plossl 9mm (1.25") wireless ★ Plossl 9mm (1.25") w/ cord ★ MA 12mm (1.25") wireless ★ MA 12mm (1.25") w/ cord **Series 4000 Photo-Visual Color Filt. (1.25")B** ★ #8 Lt Yellow ★ #11 Yellow-Green ★ #12 Yellow ★ #21 Orange ★ #23A Lt Red ★ #25A Red ★ #38A Dark-Blue ★ #47 Violet ★ #46 Lt Green ★ #58 Green ★ #80A Blue ★ #82A Lt Blue ★ Set #1 (#12, #23A, #58, #80A) ★ Set #2 (#11, #25A, #47, #82A) ★ Set #3 (#8, #21, #38A, #56) ★ Sets #1 & 2 (8 - Filt.) ★ Sets #1 & 2 & 3 (12 - Filt.) ★ Series 4000 Moon Flt.: ND96 ★ #905 Var. Pol flt. (1.25") **Series 4000 Nebular Filt.:** ★ #908N, 910N, 911N (rear cell thread) **30mm & 50mm Viewfinders:** ★ #637 6x30mm wht. tube w/bkt. ★ #545 8x50 wht. tube w/o bkt. ★ #544 8x50 blue w/o bkt. ★ Dovetail bkt. for 8x50 VF **Image Erect. Sys.:** ★ #921 Strght-thru Er.-Im. Porro Pr. (.965") ★ #924 Strght-thru Er.-Im. Porro Pr. (1.25") ★ #927 45° Er.-Im. Dia. Pr. (.965) ★ #928 45° Er.-Im. Dia. Pr. (1.25) ★ #931 7 45° Hy. Er.-Im. Dia. Pr. (.965/1.25") **Diagonal Prisms & Mirrors:** ★ #915 90° Dia. Pr. (.965) ★ #917 Hybrid Dia. Pr. (.965/1.25") ★ #918A Dia. Pr. (.1.25) ★ #929 2" Dia. Mirror (1.25"/2") ★ #930 2" Dia. Mirror (1.25"/2") **Electric Focusers:** ★ #1205 for 2080A/B and 2120 A/B ★ #1205 for LX100/LX200 ★ #1205 for ED/APO focusers **Primary & Secondary Mirrors:** ★ 6" f/5, f/8 ★ 8" f/6 ★ 10" f/4.5, f/6 ★ 12.5" f/4.8, f/6 ★ 16" f/4.5 ★ 1.30" M.A. ★ 1.52" M.A. ★ 1.83" M.A. ★ 2.14" M.A. ★ 2.60" M.A. ★ 3.10" M.A. ★ 4.00" M.A. **Sky Software:** ★ Astrosearch Sky Software (3.5" discs for Win. 3.1 or higher) ★ Astrosearch/200 Sky Software (for Meade LX200's; 3.5" discs for Win. 3.1 or higher) **Equatorial Mounts:** ★ STARFINDER Eq. Mt. ★ STARFINDER 16 Eq. Mt. ★ LXD 650 Eq. Mt. ★ LXD 750 Eq. Mt. ★ Giant Field Trilpod **Ex. Counterweights for Equatorial Mounts:** ★ 5lb., 10lb, 25lb. (1" bore) ★ 25lb. 42lb (1.5" bore) ★ 15lb. (.88" bore) **Publications, Slide Sets & Literature:** Meade Star Charts, Meade Slide Sets (20 slides): 35mm, Meade General Catalog (includes all Meade Products)

☆ NO APD PRODUCTS EXPORTED ☆

CALL US LAST WITH YOUR LOWEST TELESCOPE-ACCESSORY PRICE QUOTE!

ALL MODELS .... CALL
COMPARE AND SAVE!

FUJINON

7x50 FMT RC-SX	CALL
7X50 FMT-SX	$371
7X50 FMTR-SX	$414
10X70 FMT-SX..$469, 16X70 FMT-SX....	CALL
TRIPOD BKT.	$14

TELERAD "DEW SHIELD & RIGHT ANGLE"® ALLOWS R/A VIEWING

NEW $19

FILTER SPECIALISTS
H.R. SERIES - HIGH RESOLUTION
- PHOTO -VISUAL 1 1/4" FINEST AVAILABLE!
"WORLD'S LARGEST SELECTION"

#1A	#8	#11	#12	#15
#21	#23	#25	#29	#47
#56	#58	#80	#82A	#85

#96ND - 50% #96ND - 25% 96ND - 13%
POLARIZER, (2) for VARIABLE POLAR
(2"...$12 EA.) $11 EACH MADE IN U.S.A.
6 FILTERS ......$59, 12 FOR $108
18 FOR $162
EXCEPTIONAL FOR CCD

DOBS! CALL 6 INCH TO 16 INCH

TELRAD + BASE $39
WITH DEW SHIELD

CHRONOSTAR IIQTZ CLOCK (DC)
(LOCAL-SIDEREAL-UNIVERSAL TIME) $75

WHOLESALE OPTICS DIVISION

• PUBLIC WELCOMED • NO SALES TAX COLLECTED •
• SHOWROOMS: 57 NORTH STREET/SUITE 401, DANBURY, CT 06810 •
BUSINESS OFFICES SAT 11 to 5PM •
• PHONE ORDERS 10AM -10PM (7) DAYS A WEEK •

MAIL ORDERS TO:
29 KINGSWOOD ROAD
DANBURY, CT 06811
TEL: (203) 746-3579
FAX: CALL FOR NUMBER (24 HRS)
FAX ORDER LINE ONLY

Buyers Guide - CATALOGS

JCB
3% Credit Charge
VISA

Telescope Accessory Catalog/Data Pack (2lbs)...$10 refundable
Catalog pkg. (Telescopes - Spotting Scopes - Accessories -Binoculars) (3lbs)...$15
Catalog Charge (Out of USA) .....$29 Minimum shipping Charge (via UPS).....$5 USA
(CT Tax for in state sales only) Minimum shipping - Foreign Orders $29.00

ASIAN EXPORT CUSTOMERS WE HONOR JAPANESE CREDIT BUREAU CARDS

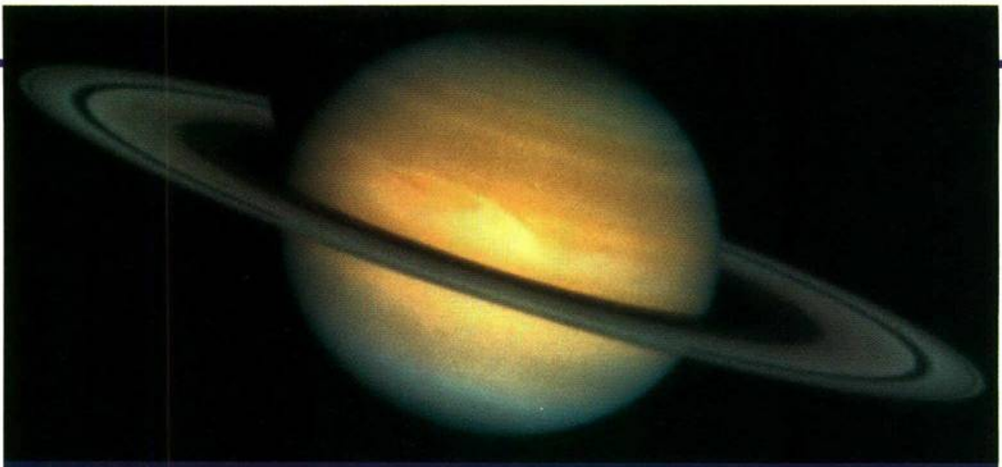
★ ★ ★ MOST ORDERS SHIPPED SAME DAY ORDERED ★ ★ ★ ★ ★ PRICES LOWER THAN RETAIL STORES ★ ★ ★ ★ BUY DIRECT AND SAVE ★ ★ ★ ★

Stellar Missing Link Found

When a star like the Sun dies, it casts off its outer layers as a planetary nebula, thereby exposing its hot core. Slowly this core cools, becoming a white dwarf star. Astronomers have found examples of stars at both ends of this evolutionary sequence — the hot stars at the centers of planetary nebulae and warm white dwarfs. What they hadn't found were the stars caught in the act of cooling. But now, observations made with the extreme ultraviolet camera on the ROSAT X-ray satellite reveal the first known star in this intermediate stage.

The team of astronomers, led by Martin Barstow of the University of Leicester in England, reported their discovery in the November 1, 1994 issue of the Monthly Notices of the Royal Astronomical Society. The star, known by its catalog designation RE 1738+665, has a temperature of 90,000 kelvins. The white dwarf has about 60 percent of the mass of the Sun crammed into a ball about twice the size of Earth. It's the hottest star ever discovered that has an atmosphere of pure hydrogen. Hotter white dwarfs exist but they have helium in their atmospheres and evolve differently than stars like RE 1738+665.

Theorists had feared that their ideas about the evolutionary sequence were wrong, that somehow the cool, hydrogen white dwarfs resulted from the hotter, helium white dwarfs. Perhap the helium settled to the core of the white dwarf with traces of lighter hydrogen rising to the surface. But the discovery of RE 1738+665 confirms that the evolutionary sequence is correct.



Reta Beebe, Diane M. Gilmore, and Louis Bergeron/NASA HST

STORMY WEATHER ON SATURN produced an arrowhead-shaped white patch near the planet's equator in September 1994. The storm arose from the upwelling of hot air from below the upper cloud decks, similar to the formation of thunderheads on Earth. The east-west extent of the storm equals Earth's diameter.

Astronomer Reta Beebe of New Mexico State University captured the image using Hubble's Wide Field/Planetary Camera 2 on December 1, 1994. Analysts Diane M. Gilmore and Louis Bergeron of the Space Telescope Science Institute processed and evaluated the image, which are sharp enough to reveal details in the cloud pattern. Astronomers hope that subsequent images of the storm will allow a model that predicts how such storms evolve in Saturn's windy cloudtops.

A Comet by Any Other Name

Objects such as Shoemaker-Levy 2 have confused astronomers. If it's an asteroid, it deserves the designation 1990 UL3, "U" telling us it was discovered in the last half of October 1990 and "L3" indicating it was the 86th object found in that interval (UA1 follows UZ and I = J). If it's a comet, it requires the designation 1990p, indicating it was the 15th comet uncovered in 1990. To make this situation even more confusing, comets also receive a designation representing the order it passed the Sun in a given year, so S-L 2 is also known as 1990 XVI. The designations detail every passage of the object by the Sun so Comet Halley, for example, is also known as 1986 III (1982i), 1910 II (1909c), 1835 III, 1759 I . . . .

To simplify the multitude of designations, astronomers have recently decided to use the asteroid system for both asteroids and comets. Objects will receive a designation containing the year and a capital letter for the half month of the discovery and a second capital letter for the order of discovery during the half month. A letter can precede the designation to indicate the nature of the object, A/ for asteroid, C/ for comet, or P/ for periodic comet. Thus the third object, a comet, discovered in the first half of March 1995 would receive the designation C/ 1995 EC. Comets that have definite orbits established shall receive sequential numbers, as asteroids do today. Routine recoveries of objects such as Comet Halley will no longer receive additional designations.

More Microlensing Events Detected

The August 1994 Astronomy ("A Brightening Star Reveals Dark Matter") reported that a group of astronomers found a microlensing event in the Large Magellanic Cloud. The event, a star that brightened over a month, occurred as an object passed in front of the star and the object's gravity concentrated the star's light as a lens would. The group, led by Charles Alcock of the Lawrence Livermore National Laboratory in Livermore, California, has since observed more than eight million stars, uncovering four other similar events in the Large Magellanic Cloud and four in the bulge surrounding the central region of the Milky Way Galaxy. Analysis of the brightenings indicates four of the eight events apparently were caused by red dwarf stars, while the remaining events were probably caused by brown dwarfs, objects too small to become stars.

The MACHO observations reveal much more information about stars than they do about microlensing events. They include data on over 8,000 RR Lyrae stars and almost 2,000 Cepheids, two groups of variable stars that astronomers use to determine distances to galaxies (see "Candles to Light the Night," September 1994). And they have uncovered a new type of variable star the team calls "bumpers" because the star's light output suddenly increases by 25 percent and then returns to normal. These stars may be cousins of known emission-line stars. ☐

CELESTRON®

GP-C102-ED

GP-C102 TELESCOPES — The Celestron line of 102mm German equatorial mount refracting telescopes is for the more serious astronomer who appreciates exquisite optics and stable mounts.

The Great Polaris (GP) German equatorial mount is the new, upgraded evolution of the Super Polaris (SP) mount.

The fine Japanese optics include a superb achromat (1000mm fl) in the standard GP-102. The GP-C102-ED is a super premium refractor utilizing super ED glass which rivals the best color correction, resolution and contrast of any refractor in its class — it is 900mm fl.

1.25" Eyepiece Filters

EYEPIECE FILTERS — These filters are an invaluable aid to lunar and planetary observers. They reduce glare and light scattering, increase contrast by selective filtration, increase definition and resolution, reduce irradiation and lessen eye fatigue.

Celestron offers the most complete line of eyepiece filters in the industry but more importantly — the finest quality filters.

Celestron filters offer 18mm clear aperture for the .96" size, a full 26mm clear aperture in the 1.25" size and 44mm clear aperture in the **2" size**. The filters utilize quality, solid plane parallel glass with excellent homogeneity. The filters are anti-reflection coated on **both sides** of the glass to prevent glare and ghosting.

The filters are mounted in black anodized aluminum cells with the Kodak Wratten Series engraved on each one and they are supplied in a plastic case.

COMA CORRECTOR — This multi-purpose Coma Corrector virtually eliminates coma and astigmatism in Newtonian telescopes without increasing the focal ratio of your telescope. Its unique lens design utilizes a multi-coating on all air-to-glass surfaces to allow 97% transmission (with maximum transmission in the hydrogen-alpha region of the spectrum). Although optimized for f/4.5 mirrors, it works well with mirrors from f/4 to f/6. Stars remain 12 micron dots over the entire field.

Coma Corrector

It can be used BOTH visually and photographically. Fits virtually all 1.25" and 2" focusers and off-axis guiders with the adapters supplied. New version allows the visual use of 2" oculars.

LV Eyepieces

LV EYEPIECES — A new generation of eyepieces using the rare earth glass — lanthanum. **All** focal lengths have a **20mm eye relief!** Optics are all **fully multi-coated.** The results are excellent and high power viewing is more relaxed.

FOCAL LENGTH	BARREL DIA.	APPARENT FIELD
2.5mm	1¼"	45°
4mm	1¼"	45°
5mm	1¼"	45°
6mm	1¼"	45°
9mm	1¼"	50°
10mm	1¼"	50°
15mm	1¼"	50°
20mm	1¼"	50°
25mm	1¼"	50°
30mm	2"	50°

2" Star Diagonal

DIAGONAL – 2" — A standard 2" Mirror Star Diagonal. It is an improved version of the unit previously offered and it includes an adapter to accept 1.25" eyepieces. It has **multi-coated** optics and the mechanics are smooth and precision manufactured.

REDUCER/CORRECTOR f/6.3 — This combination focal reducer and field corrector lens accessory works with all Celestron C5's, C8's, C11's and C14's. Now it is possible to have a dual focal ratio instrument without sacrificing image quality. The Reducer/Corrector is f/6.3 for C5, C8 and C11, f/7 for C14. The drawbacks of a dedicated f/6.3 Schmidt-Cassegrain with its much larger central obstruction (causing reduction of contrast) and the inability to utilize longer focal ratios for certain objects led us to design this four element, **fully multi-coated** accessory. Results are amazing BOTH visually and photographically. ***Far superior to competitive units!***

Reducer/Corrector f/6.3

RADIAL GUIDER — Specifically for use in prime focus, deep sky astrophotography, the Radial Guider is compact and sleek in design. It allows you to simultaneously photograph and guide through the optical tube assembly of your telescope. With the Radial Guider, the problem of differential flexure is eliminated as you are both guiding and photographing through the telescope. It includes: "T"-shaped body, prism adjustment screw, eyepiece holder and screws.

This guider is a tremendous improvement over conventional off-axis guiders. **The angle of the prism is tunable**. It has a fixed rigid camera orientation while the user is free to move the guiding eyepiece radially about 135°!

Radial Guider

MFFT-55

MFFT-55 — Celestron's Multi-Function Focal Tester-55 (MFFT-55) is a focusing aid designed to allow astrophotographers to accurately evaluate their telescope's focal plane in three main areas of interest: focus, collimation (squareness), and curvature of field. With the MFFT-55, you can focus on and off the optical axis at 3, 16, 22 and 30mm diameters in four quadrants in a single setup.

The MFFT has a black anodized tube and a glass plate with opaque and reflective coatings etched into a three zone reticle pattern. The glass plate is positioned at 55mm — the exact distance from the front face of the T-ring to an SLR film plane. It screws onto the Radial Guider to achieve "perfect" focus.

FLASHLIGHT — A flashlight with a **red LED** for star map reading and night use at the telescope. The LED does not impair night vision. Also great for bird watchers to study field guides in low light conditions without disturbing the birds. Compact at only 6" long and weighs just 2.5 oz. Two AA batteries are included.

Flashlight, LED

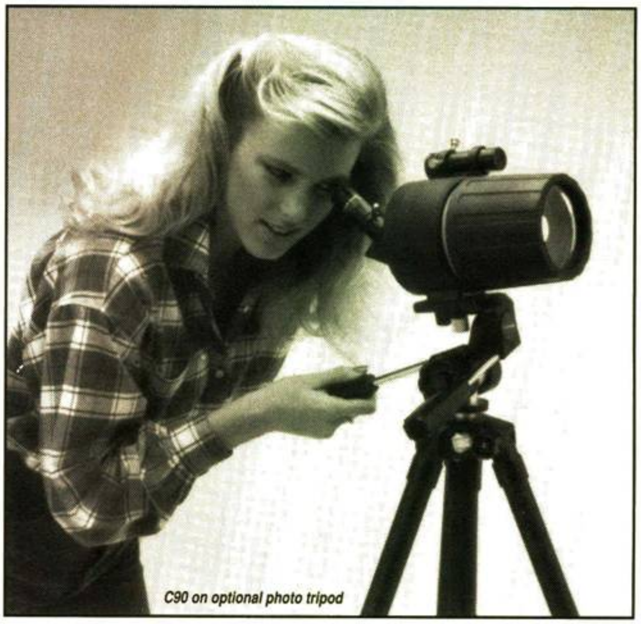
Accessory Case

ACCESSORY CASE — Protect your investment in quality optics and accessories with a rugged carrying case. Celestron's Accessory Case is constructed of durable ABS plastic. The inside has foam padding, die cut in small squares allowing you to custom fit your accessories. Size 13" x 10" x 5.75".

C90 SPOTTING SCOPES — Over the years, the C90 has proven to be the most popular Celestron spotting scope. Used by tens of thousands of satisfied customers worldwide. Clearly the world's leader in this size spotting scope.

Superb optics — a full 90mm (3.55") aperture f/11 Maksutov-Cassegrain mirror lens optical system. At only 3' pounds and 7¾" in length, the C90 is light and compact enough to travel with you anywhere.

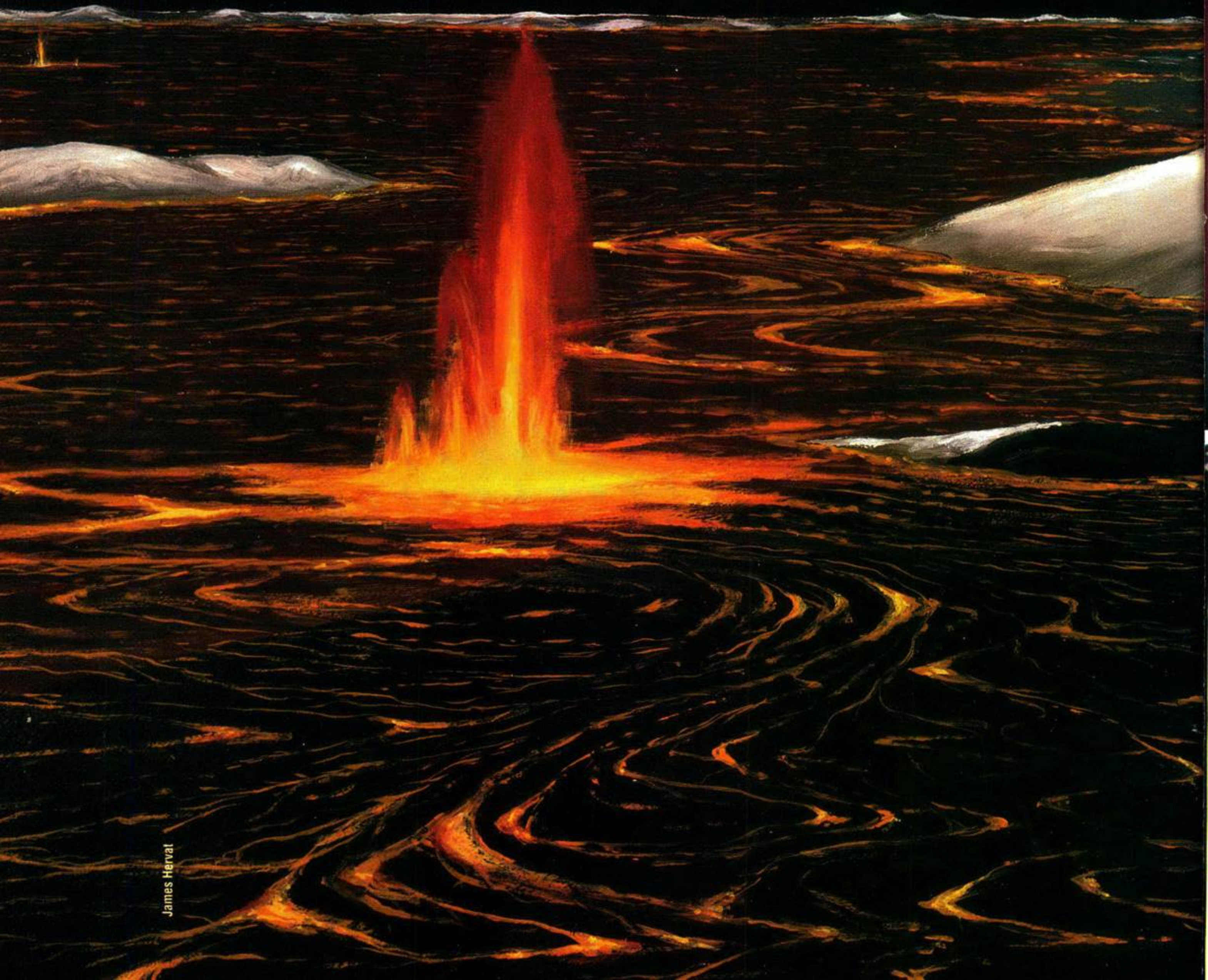
Several models are available — some with rubber coverings, some with 1¼" accessories and most with multi-coating. **Made in the USA!**


C90 on optional photo tripod

CELESTRON® LIGHT YEARS AHEAD OF THE COMPETITION

Celestron International • 2835 Columbia Street • Torrance, CA 90503
(310) 328-9560 • FAX (310) 212-5835

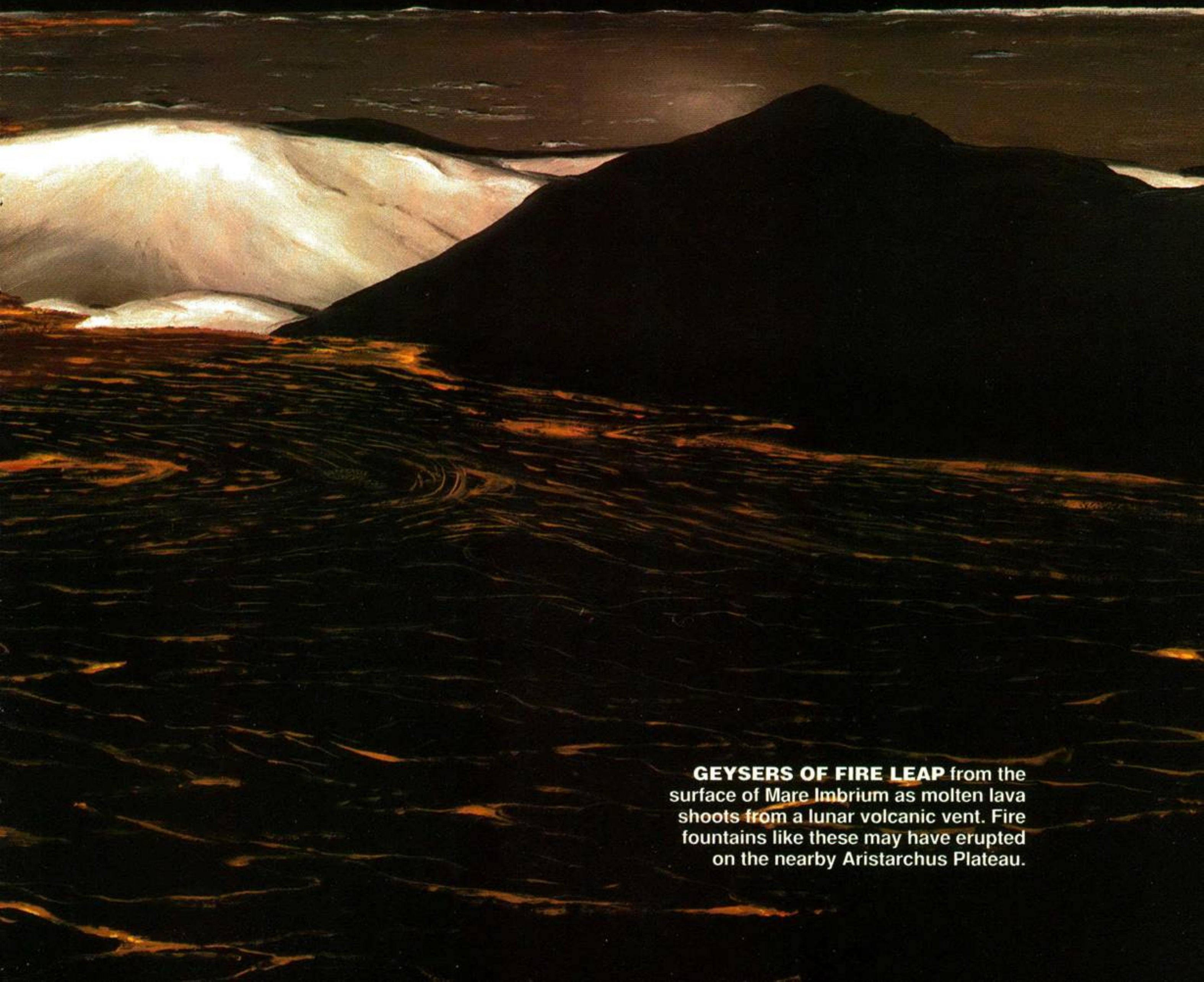
The Fire Fountains of Aristarchus



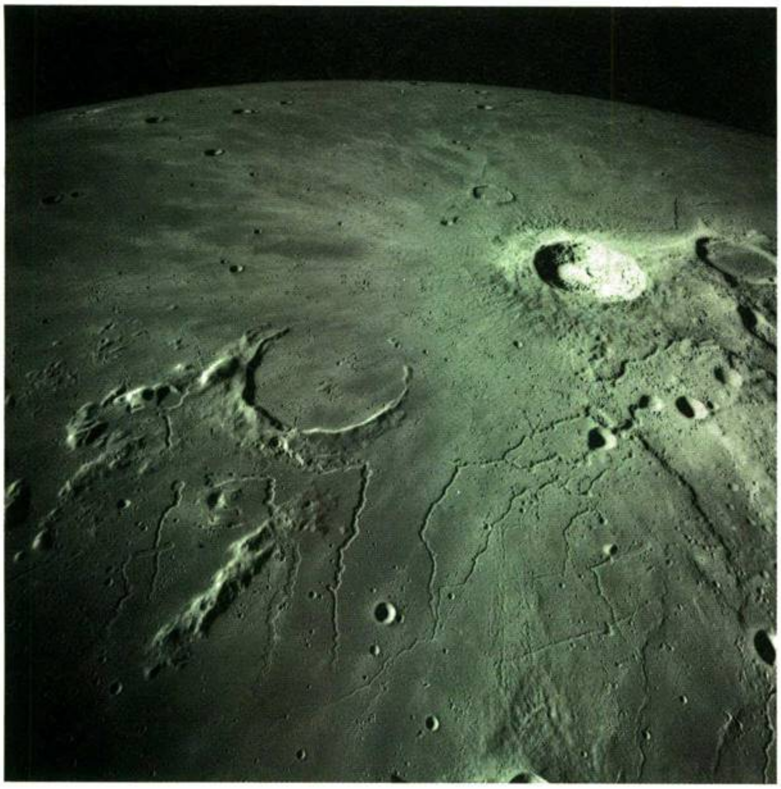
James Hervat

A tiny area of the Moon once erupted volcanically with extreme violence. With the help of new spacecraft data, lunar geologists are beginning to understand what happened on the Aristarchus Plateau.

by Graham Ryder and Cassandra Coombs



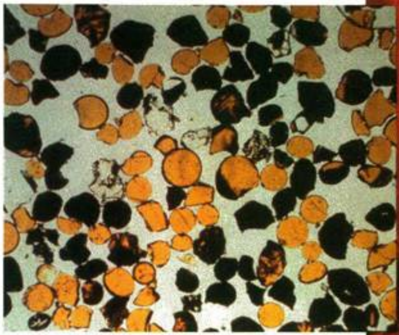
GEYSERS OF FIRE LEAP from the surface of Mare Imbrium as molten lava shoots from a lunar volcanic vent. Fire fountains like these may have erupted on the nearby Aristarchus Plateau.



NASA Apollo 15 mapping camera frame 2607

SAIL ALONG, SILV'RY MOON. The images at left and right (and on the following pages) show a sequence of pictures of the Aristarchus Plateau as photographed from the Apollo 15 command module in lunar orbit.

JETS OF MOLTEN LAVA will cool to produce tiny glass spherules such as these samples of the famous "orange soil" from Apollo 17 (below). On the Moon, lava fire fountains would dwarf those of Hawaii (right) in scale and length of activity.



Graham Ryder

On the northwest edge of Mare Imbrium stands the Aristarchus Plateau, a lunar region with a history like no other. Here, more than 3 billion years ago, volcanic vents shot red-hot lava miles into the sky and showered glassy droplets over an area perhaps as big as Rhode Island. Had anyone been there to see it, they would have witnessed a hellish sight, with fountains of fire leaping up to paint the landscape in bright flashes of yellow and orange. And the show went on for tens of millions of years.

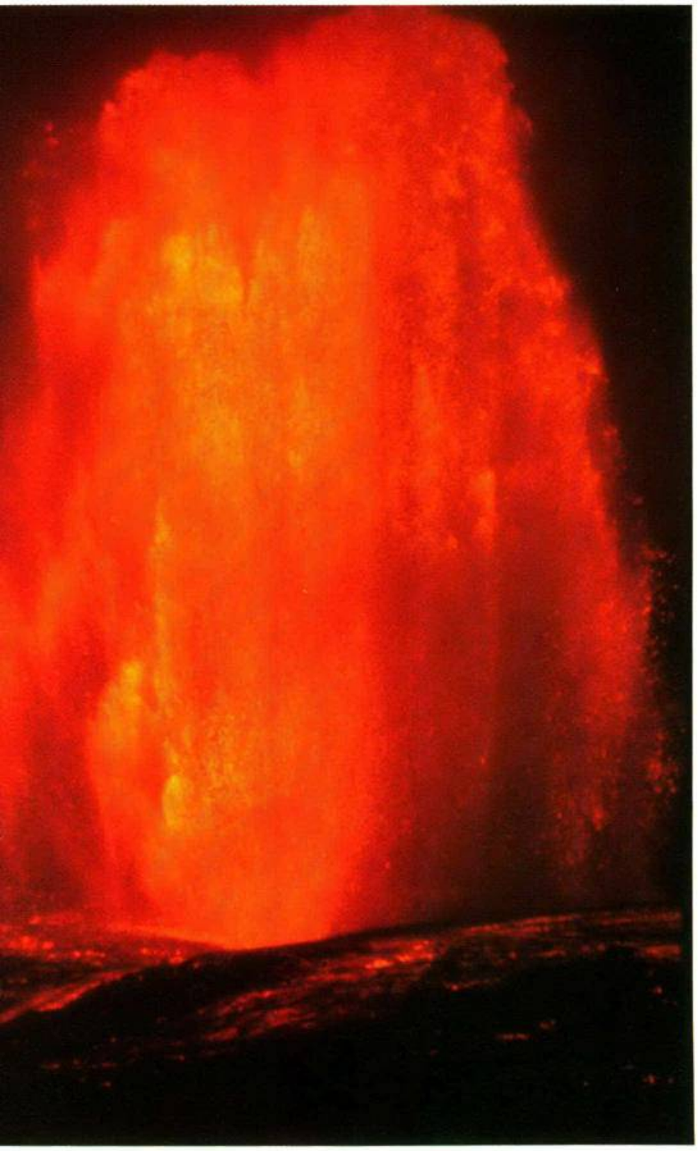
The eruptions completely dwarfed any similar ones on Earth today, where the largest fire fountains occur in Hawaii. These jet only a few hundred feet high and last just a few days. The activity at Aristarchus was so different in scale and extent that it poses a major puzzle for scientists. How could such a small area be so active on a body the size of the Moon?

The Aristarchus region has long been known to be unusual. Nearly 30 years ago, lunar scientists put the Aristarchus Plateau on the short list for an unmanned Surveyor mission and then later for an Apollo landing. Unfortunately, the site didn't make the final cut for either. Within the last year, however, data from the Clementine lunar orbiting mission have shown the plateau to be even more complex and interesting than scientists had thought, so the logical next step is a sophisticated geological and geochemical field study using a robotic roving lander, something scientists hope to accomplish later this decade.

Backyard astronomers, of course, have been visiting this part of the Moon for ages (see "Probing the Aristarchus Area," September 1994). The crater Aristarchus, 25 miles across and 2 miles deep, is one of the Moon's brightest and also one of the youngest, being only about 450 million years old. (When it formed, living creatures on Earth were making the transition from the ocean to land.) The brightness of Aristarchus is eerie at times. You can see it by earthlight before lunar sunrise, and its ghostly radiance once fooled William Herschel into thinking it was erupting. Perhaps for this reason, Aristarchus remains the Moon's #1 source for reports of transient phenomena — glows, gas emissions, and the like — although none of these have ever been confirmed.

Although the crater attracts much attention, the plateau it stands upon is less well explored. It forms a distinct island set in the lava seas on the border between Mare Imbrium and Oceanus Procellarum. While Aristarchus is bright, the plateau counts among the Moon's darkest features. Its unusual nature was noted as far back as 1647, when Johannes Hevelius stated (correctly) that it was redder than the rest of the Moon. In 1912, R.W. Wood found that it had the lowest ultraviolet reflectance of the entire nearside. During the Space Age, the region was photographed by the unmanned Lunar Orbiter missions, surveyed by the chemistry-measuring instruments and cameras on the Apollo 15 mission, probed by sophisticated radar and spectroscopic instruments from Earth, and explored most recently by multispectral cameras on Clementine.

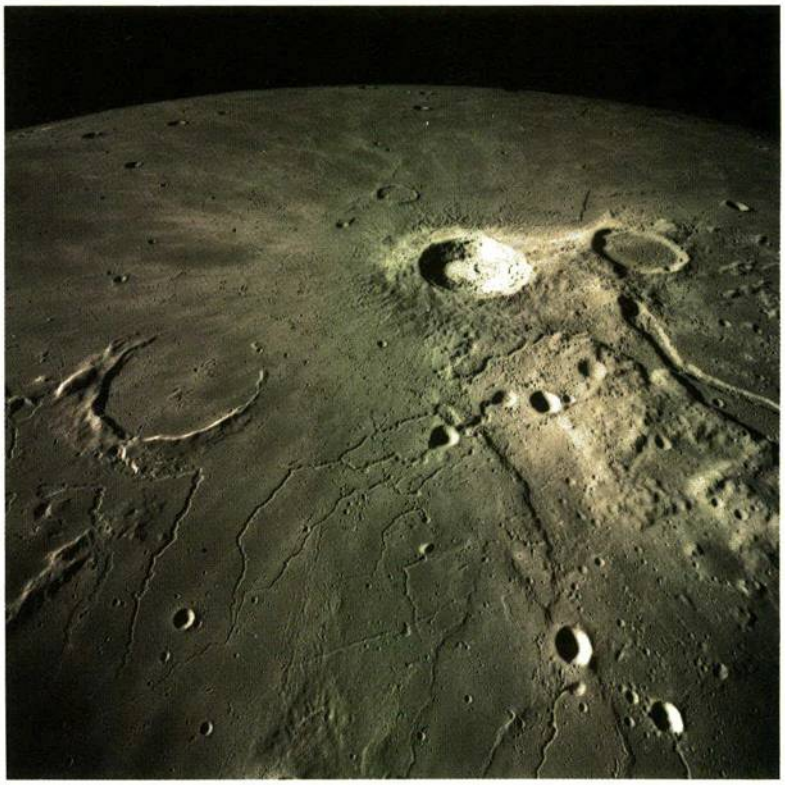
Lunar geologists think the plateau was born when a block of highland crust was heaved up during the massive impact that created the Imbrium basin about 3.85 billion years ago (see pages 38-39). Roughly diamond-shaped, the plateau measures about 100 miles on a side. *Clementine altimetry shows that the plateau* rises about a mile above Oceanus Procellarum along its southern edge (which is probably bordered by a deep



Scott Rowland (Pu'u O'o eruption, September 1985)

fault) and tilts down toward the northwest. Regrettably, much of the plateau's structure has been blanketed by ejecta from impact events — especially the Imbrium strike — and later volcanic eruptions. Thus the details of its original form are lost.

In trying to understand what forces drove the Aristarchus region, geologists focus most on its complex features, in particular the volcanic ones. The most striking feature of the plateau is the famous Schröter's Valley. Big enough to be seen with a small telescope, the valley is the Moon's largest sinuous rille. It starts in a deep hole about 6 miles across called the Cobra Head and descends about 2.5 miles on a twisting, 100-mile-long path before it spills off the plateau into Oceanus Procellarum. More than half a mile deep in places, the valley is commonly 5 to 6 miles wide. It's far too large to have been carved out solely by lava flows. Instead, it probably originated in faults related to the formation of the plateau itself. Schröter's Valley, then, is in reality a collapsed line of blocks that formed a channel later lava flows ran through.

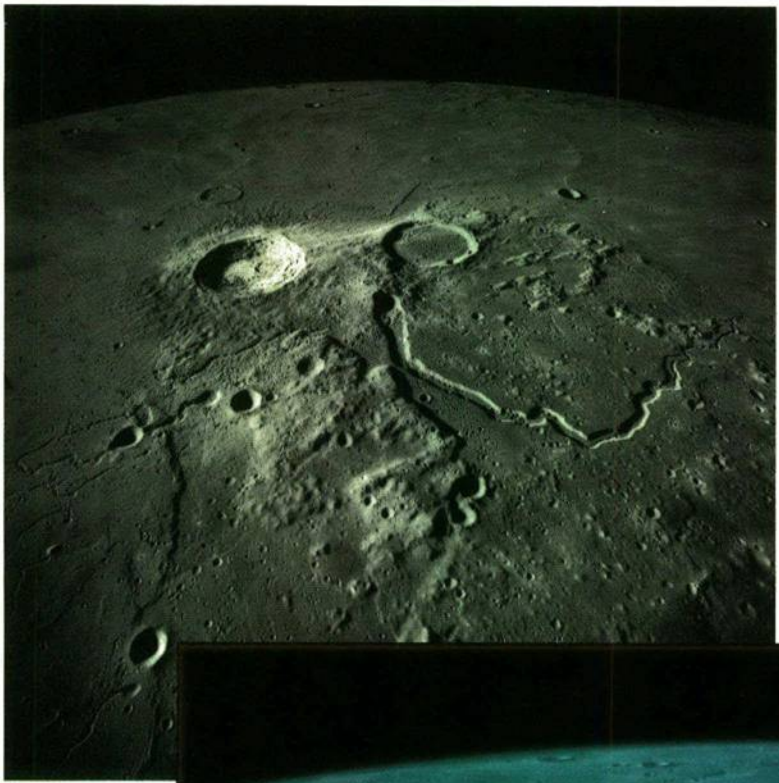


NASA Apollo 15 mapping camera frame 2608

Hinting at this is a much narrower and extremely winding rille that threads along the bottom of the main valley. It is just visible from Earth under excellent seeing with a large telescope. The scale of this rille comes much closer to that of other rilles known to be lava channels. Some of these small rilles, many with their own little "cobra heads," have carved paths across the plateau. Geologists believe that the lavas that eroded these channels were very fluid and rich in iron. Some channels must have helped feed the surrounding mare plains, where the lava cooled to form rocks like the mare basalts collected on the Apollo and Luna missions.

Volcanism also accounts for the darkness and redness of the plateau. From studies of older photography as well as recent Clementine pictures, geologists suspect that a thin blanket or mantle of eruptive debris only a few tens of meters thick covers much of the plateau like an uneven coat of paint. The blanket may have once extended beyond the plateau itself, but the mare lavas that flooded the lower ground have erased the evidence. Radar and spectroscopic observations showed that the dark blanket is probably a very smooth deposit containing tiny iron-rich glass beads; new Clementine results have confirmed an extensive blanket of glass. As it happens, geologists are quite familiar with volcanic glass beads from terrestrial and lunar samples. The Apollo astronauts collected many of these, the orange glass from Apollo 17 being the most famous example (see above left). Laboratory studies of the samples suggest they are similar to those believed to exist on the Aristarchus Plateau.

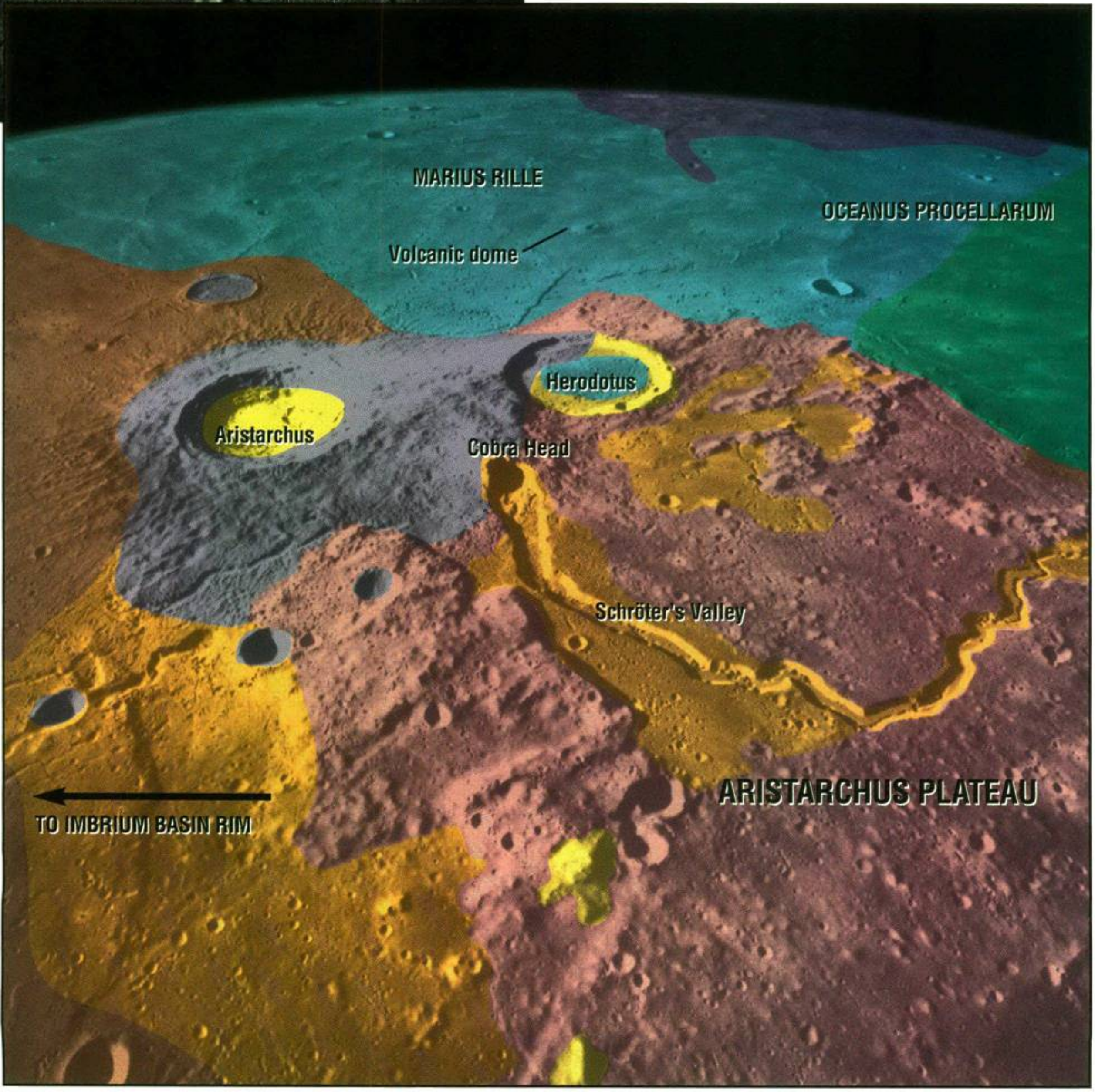
The plateau's landforms, its smoothness, and the glass all point toward lava sprays from fire fountains as a source for the dark mantling material. But the sheer amount of the blanketing — dozens of miles in extent — hints that the fountains must have been awesome. Fire fountains draw their energy from the nature of the



NASA Apollo 15 mapping camera frame 2610

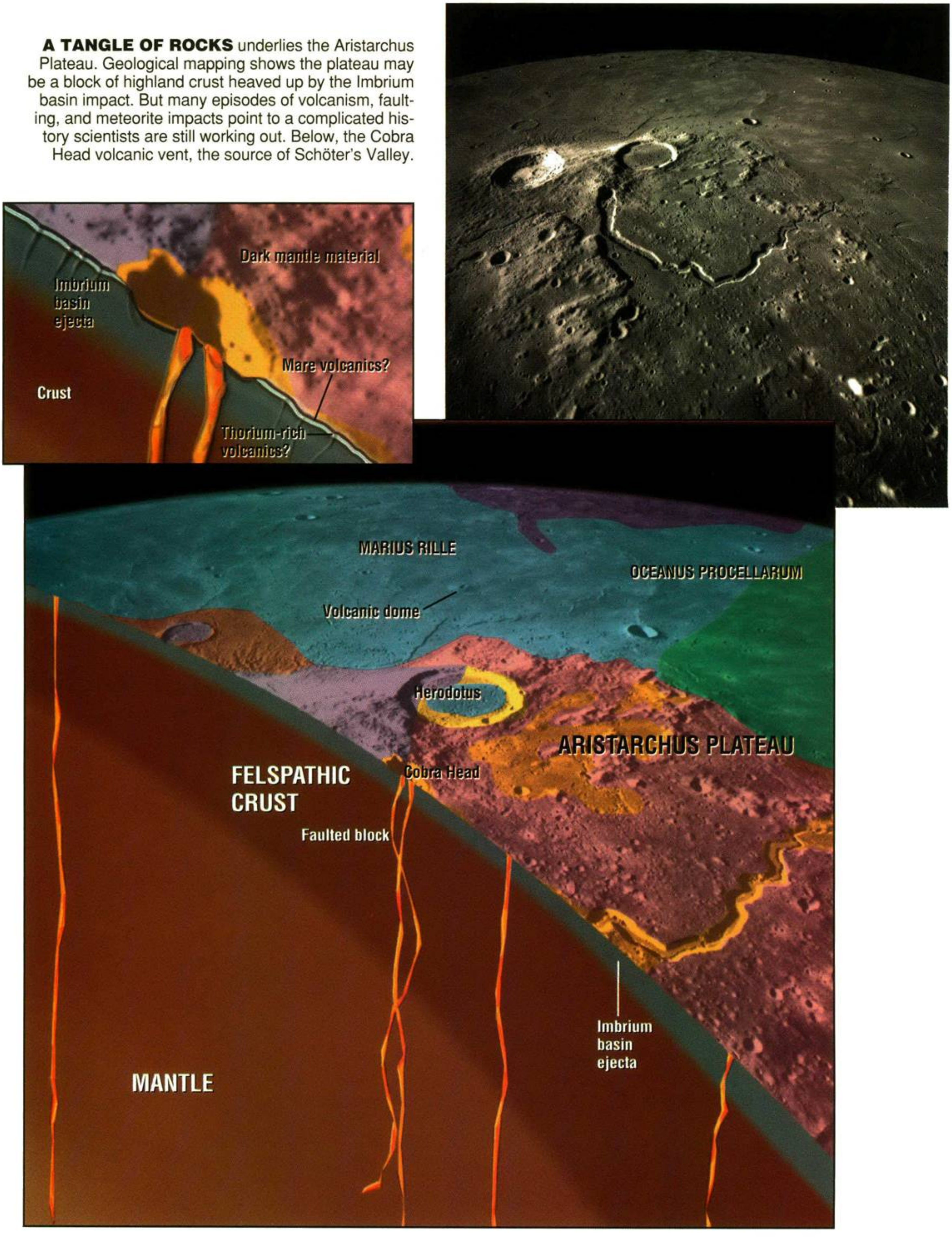
Geohistory in a Snapshot

🟪 Young crater ejecta (less than 2 billion years old)
⬛ Marius volcanic flows (less than 2.5 b.y. old)
🟩 Youngest mare volcanic flows (2.5 b.y. old)
🟦 Older mare volcanic flows (2.5-3.5 b.y. old)
🟫 Oldest mare volcanic flows (3.5 b.y. old)
🟧 Schröter's Valley formation (3.7 b.y. old)
🟥 Hummocky plateau material (3.7-3.85 b.y. old)
🟨 Imbrium basin ejecta (3.85 b.y. old)


MARIUS RILLE
OCEANUS PROCELLARUM
Volcanic dome
Herodotus
Aristarchus
Cobra Head
Schröter's Valley
ARISTARCHUS PLATEAU
TO IMBRIUM BASIN RIM

Graham Ryder/ASTRONOMY: Steven G. Davis

A TANGLE OF ROCKS underlies the Aristarchus Plateau. Geological mapping shows the plateau may be a block of highland crust heaved up by the Imbrium basin impact. But many episodes of volcanism, faulting, and meteorite impacts point to a complicated history scientists are still working out. Below, the Cobra Head volcanic vent, the source of Schöter's Valley.


Dark mantle material
Imbrium basin ejecta
Mare volcanics?
Crust
Thorium-rich volcanics?
MARIUS RILLE
OCEANUS PROCELLARUM
Volcanic dome
Herodotus
ARISTARCHUS PLATEAU
FELSPATHIC CRUST
Cobra Head
Faulted block
Imbrium basin ejecta
MANTLE

NASA Apollo 15 mapping camera frame 2611

NASA .Apollo 15 mapping camera frame 2612

NASA Apollo 15 panoramic camera frame 343

Aristarchus Plateau: A History

0.45? billion years ago	**Aristarchus crater impact**
2.50-3.50? b.y.a.	**Mare flooding**
3.00-3.70? b.y.a.	**Fire fountains, domes, and rilles**
3.70-3.80? b.y.a	**Mare flooding; Herodotus crater**
3.80-3.85 b.y.a	**Resurfacing by Orientale ejecta? Thorium-rich volcanic flows?**
3.85 b.y.a.	**Imbrium basin impact; plateau formation**
3.9-4.5 b.y.a	**Lunar crust forms and evolves; many impacts**

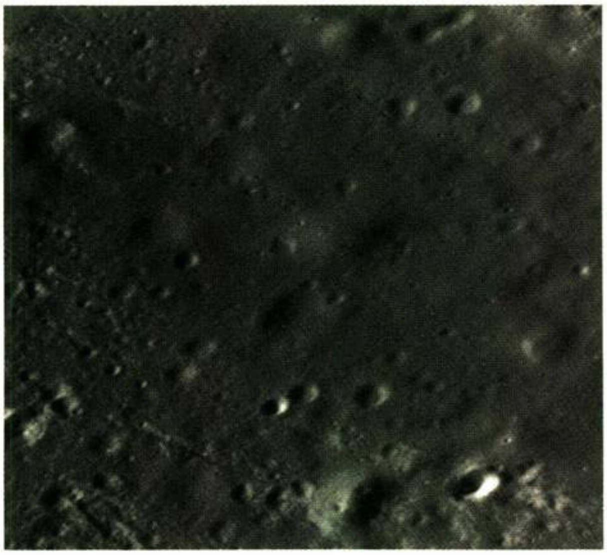
eruption. On Earth, fountains can occur when shallow magma chambers have their lava forced out by new magma rising from below. The displaced magma may explode into spray as volatile material (such as water dissolved in the magma) bursts out of solution when the lava reaches Earth's surface.

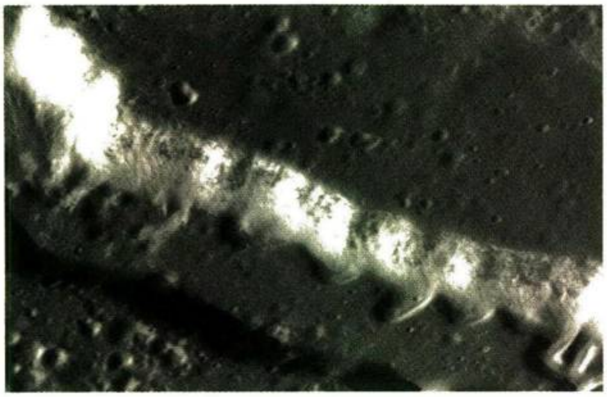
On the Moon, however, fire fountains worked differently. For one thing, volatiles probably played a much lesser role — lunar lavas are very poor in volatiles and water is totally absent. Instead, lava rushed up from several hundred miles down, moving so fast that it just kept on going when it reached the surface. (Calculations suggest eruption speeds of 200 miles per hour.) As the molten material shot into the airless lunar sky, it fragmented into droplets that rapidly cooled to form glass beads before falling back to the surface. But while fire fountains on Earth and the Moon probably operate quite differently, scientists really know little about the lunar eruptions because no one has ever inspected their aftermath close-up.

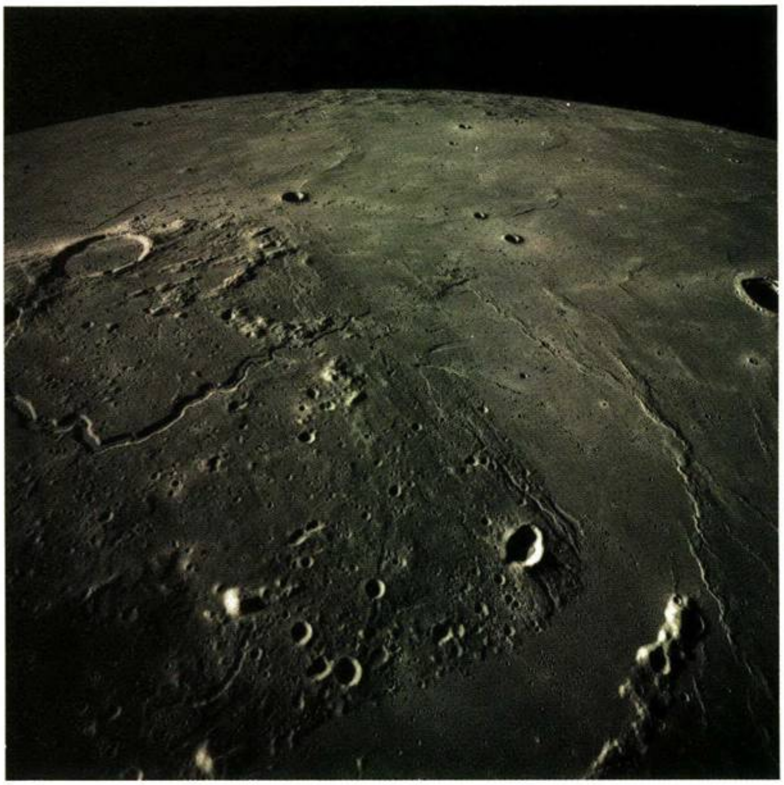
Evidence for fire fountains is widespread on the plateau. But how many eruptions occurred, or even how many separate vents there were, is unknown. Geologists would like to have samples of the Aristarchus beads to investigate their composition. Samples could also help tell them how much lava was sprayed at one time. In any case, the particular magmas that made the glass beads collected on Apollo missions did not have the same chemical composition as the rocky samples of mare lavas.

Until the matters are resolved, scientists won't know for sure how lunar fire fountains worked or why they happened. We need to observe from ground level, geologists say; we need to get in touch. An unmanned rover craft could do a lot of work on the Aristarchus Plateau. It would need to have fairly good "eyes," both for looking closely at the rocks in front of it as well as for remote operation from Earth. The probe would also need instruments capable of measuring chemical and mineralogical characteristics. But these all lie well within current technology and should also fit the guidelines of NASA's Discovery program for inexpensive planetary projects (see "Cheap Shots," August 1993). *In fact, the rover needn't* differ much from that designed for the Mars Pathfinder mission (see "To Boldly Go," December 1994).

SNAKING ACROSS THE PLATEAU, Schröter's Valley (left) probably originated as a fault zone and then acted as a channel for lava flows coming from the Cobra Head (half-visible at upper left corner). Smooth dark material from fire fountains mantles the surface (below), while flat-lying layers of rock making up the plateau appear in the walls of the valley (bottom).







NASA Apollo 15 mapping camera frame 2613

Chemical analysis is critical to understanding the Aristarchus region. When rocks melt, some elements go much more readily into the liquid rock than others do. (In a mixture of ice and water, for example, any salt prefers to be in the water.) One element that both mixes well and is easy to detect as a tracer is radioactive thorium. The crater Aristarchus, it turns out, has the highest thorium abundance measured on the Moon. The plateau lavas, too, have a lot of thorium and some may also be in the basalts that covered the plateau soon after the Imbrium basin impact. Among Apollo samples in general, some of the greatest thorium abundances occur in rocks from the highlands. Yet at Aristarchus, it's likely that some of the thorium lies in the fire-fountain blanket of debris, which is believed to be related to mare basalt activity that occurred much later. At this point, the picture is tangled. But because it is so easily detected, tracing thorium will be a key part of unravelling the intricacies of volcanism on the Aristarchus Plateau.

Can the bright crater Aristarchus itself contribute to the effort? In fact, it's almost more a hindrance than a help. The object that created it struck on the boundary between Oceanus Procellarum and the plateau. The crater's ejecta partly covers the volcanic terrain scientists are interested in, making analysis that much more challenging. On the other hand, the impact punched through the overlying glass deposits and volcanic flows to reveal the plateau's highland crust.

And there's no question the crater shows interestingly complex details. The ejecta blanket surrounding Aristarchus is asymmetric, both in extent and chemical composition, as are the crater's walls. Discontinuous ejecta reaches out as much as 200 miles from the crater rim, while lobes of excavated highlands material extend north and west of the rim as much as 50 miles (see pages 38-39). On the mare side both highlands and mare volcanic materials are exposed around the rim, and a mixture of them forms the blanket farther out. The small central peak in Aristarchus may be a chunk of ancient, deep crust. The walls, meanwhile, show shallower crustal materials different in composition. Scientists need to analyze Clementine data further to explore the crustal rocks underlying this part of the Moon.

Studies of the Aristarchus Plateau have a very instructive story to tell about an enigmatic region of the Moon. Over the next few years research into the Clementine data will add to our knowledge. And if a Discovery-class mission goes ahead, Aristarchus may yet have its visitors from Earth — and lunar geologists will finally achieve a decades-old goal. ☐

Graham Ryder is a lunar scientist at Houston's Lunar and Planetary Institute. His last article was "Apollo's Gift: the Moon" in July 1994. Cassandra Coombs is a planetary scientist at the College of Charleston (S.C.) where she specializes in remote sensing and volcanism of the Earth and planets.

Meade & Celestron
LUMICON Carries a full line of telescopes & accessories. Fast Delivery, competitive prices

LUMICON FOR HIGH PERFORMANCE

LUMICON H-BETA
LUMICON OIII
OIII
LUMICON UHC
LUMICON DEEP-SKY

FILTER OF THE MONTH: The LUMICON **UHC Filter** will help you see the large nebula NGC 2174/5 at the northern tip of Orion. NGC 2174/5 is as large as M-42!

"I'd Pick The TELE VUE™"

40mm Wide-Field Test, "Astronomy," Aug. 1990, p. 90

Genesis-SDF 4" f/5.4 apochromat .. $1950
Pronto 70mm f/6.4 apochromat w/2" diagonal $869
Pronto 70mm f/6.4 w/45° erecting prism $740
Renaissance-SDF 4" f/5.4, brass ... $2150
Gibraltar mount with ash wood tripod . $495
7.4, 10.4, 13, 17, 21, 26mm Plossl 50° .. $79
1.8x or 2.5x Tele Vue Barlow Lens $95
2" Giant Barlow - 2x $179
32mm Plossl, widest true field in 1¼" .. $119
55mm 2" Plossl, widest possible field . $229
15mm Wide-Field, 1¼" eyepiece, 65° . $139
19mm Wide-Field, 1¼" eyepiece, 65° . $149
4.8mm Nagler, 82° field, 1¼" eyepiece $169
7mm Nagler, 1¼" eyepiece, 82° field .. $219
9mm Nagler, 82° field, 1¼" or 2" $239
13mm Nagler, 82° field, 1¼" or 2" $279
12mm Nagler, Type II, 82°, 1¼"/2" $279
16mm Nagler, Type II, 82°, 1¼"/2" $299
20mm Nagler, Type II, 82°, 2" only ... $375
1¼" Paracorr Visual Coma Corrector $159
2" Paracorr Visual Coma Corrector . $249
NEW! 15mm Panoptic 1¼", 68° field $209
NEW! 22mm Panoptic 1¼"/2", 68° .. $269
NEW! 27mm Panoptic 2", 68° field .. $319
NEW! 35mm Panoptic 2", 68° field .. $349

ADJUSTABLE PIGGYBACK MOUNT

The LUMICON adjustable piggyback mount is ideal for telescopes of 6-16" aperture. It permits **both** vertical and sideways adjustment for optical alignment. Also ideal to mount LUMICON 80mm SUPER-FINDER™, large telephoto lenses and small telescopes up to about 5 lbs.

LUMICON Adjust. Piggyback Mount $59.50
Specify telescope size: 6", 8", 10", 11", 14", 16"

H-ALPHA PASS FILTER

Yields spectacular contrast gains in B&W photograph with telephoto lenses. Yields pinpoint star images. Superb with hypered 2415. For color, use the Minus Violet (MV) Filter.

Specify Lens Size	**H-Alpha**	**(MV)**
46, 48, 49mm	$59.00	$49.00
52, 55, 58, 62mm	$69.00	$59.00
67, 72, 77mm	$79.00	$69.00
82mm	$89.00	N/A

Hypered 2415 film, 36 exp .. **$11.95, $3/$32**

LUMICON®
2111 Research Dr. #5A, Livermore, CA 94550
For phone orders please call (510) 447-9570
FAX (6 PM-9 AM PST) (510) 447-9589
LUMICON Products catalogue FREE
All foreign orders add 8% ($10 minimum)
California residents add 8.25% tax.
Prices subject to change w/o notice.
Hrs: M-F 9 am - 5 pm, Sat. 11 am - 3 pm

NEW! ENHANCED ALUMINUM DIAGONAL MIRRORS BOOST TELESCOPE PERFORMANCE

LUMICON 1.3" & 2.1" enhanced aluminum diagonal mirrors & 1¼" star diagonal.

The new LUMICON diagonal mirrors have a special enhanced aluminum coating with a protective overcoating for long life. Visible reflectivity is 94-96% compared to 86-89% for standard aluminum coated mirrors. The extra 5-10% transmission is like adding up to an inch of aperture! The substrate is fine annealed Pyrex flat to 1/8 wave.

1.32" **$39.50** 1.52" **$45.00** 1.83" **$49.50**
2.14" **$59.50** 2.60" **$75.00** 3.10" **$99.50**

ENHANCED ALUMINUM STAR DIAGONAL

90° star diagonals with 96% reflectivity enhanced aluminum mirrors in a CNC machined black anodized aluminum body. Performance far exceeds prism diagonals.

1¼" (1.32" mirror) **$99.50**
2" (1.83" mirror)(see photo above) .. **$169.50**

LUMICON FILTERS — BEST IN THE WORLD!

"The LUMICON O-III proved to be our favorite... It gave the greatest contrast gain."
ASTRONOMY February 1991

AMAZING O-III FILTER™

Helix Nebula, NGC 7293 in Aquarius. Bright and easy with Lumicon Oxygen-III Filter.

The ultimate in filter performance! The Lumicon Oxygen-III Filter has a contrast twice as high as the high performance Lumicon UHC Filter™. Use the Oxygen-III Filter for observing the very faintest planetary and diffuse emission nebulae. Also gives incredible views of bright nebulae (like M-27, M-17, etc.) from urban locations. Bandpass is 11nm, transmission is 90-96% for both O-III lines at 496nm and 501nm.

SEE THE HORSEHEAD!

Horsehead Nebula in Orion. This faint nebula is seen best with a LUMICON H-Beta Filter. Photo by J. Marling using a Deep-Sky Filter.

"I CAN SEE THE VEIL NEBULA!"

Rich Zepernick saw the Veil Nebula for the very first time with a **LUMICON UHC Filter**. He stated, *"It was actually there! and not just around 52 Cygni, but the whole loop! Words cannot possibly express my feelings. I don't know how I managed without these filters."*
Rich Zepernick, Cresskill, NJ

DEEP-SKY FILTER™

BEST for Astrophotography!

"Stunning is all I can say," says noted astrophotographer Jack Newton. Great for BOTH color and black and white photography.

BEST WIDE-BAND FILTER!

*"Based on our tests we'd recommend a LUMICON Deep-Sky and Oxygen-III as complementary filters. The LUMICON Deep-Sky Filter clearly had the best contrast for **reflection** nebulae."*
Astronomy, Feb. 1991

Premium*
0.96" LUMICON DEEP-SKY Filter threads into most 0.96" eyepieces **$59.50**
1¼" LUMICON DEEP-SKY Filter threads into most 1¼" eyepieces **$79.50**
48mm LUMICON DEEP-SKY Filter (1.7" aperture), threads into most 2" eyepieces. Also fits LUMICON EASY-GUIDERS **$119.50**
2" LUMICON DEEP-SKY Filter (1.5" aperture), threads into most 2" eyepieces. Also has male & female camera T-threads for prime focus photography **$119.50**
72mm LUMICON Giant DEEP-SKY Filter (62, 67, 77mm adapter, $8) **$299.50**
2" Rear Cell Filter, fits SCT's .... Deep-Sky, **$119.50** UHC, O-III, H-Beta, **$199.50**
1¼" LUMICON UHC Filter threads into most 1¼" eyepieces **$99.50**
48mm LUMICON UHC Filter (1.75" aperture) fits most 2" eyepieces **$199.50**
DEEP-SKY and choice of **UHC, O-III or H-BETA** Filter (**Save 11%**) 1¼" **$159.50**; 48mm **$279.50**
LUMICON H-BETA Line Filter (9mm bandpass at 486nm). For the California Nebula, Horsehead Nebula, and other extremely faint nebulae. **1¼"** .... **$99.50, 48mm** **$199.50**
Oxygen-III Filter for very faint planetary and diffuse nebulae, 11nm bandpass at 496nm and 501nm O-III lines .... **1¼" $99.50, 48mm $199.50**
Telephoto lens adapter for 2" or 48mm filter. Select 46, 49, 52, 55, 58mm **$7.50**
Universal adapter for 1¼" filters. Adapts the 1¼" filters to any 1¼" eyepiece **$19.50**
Universal adapter for 48mm or 2" filters. Allows use of any 1¼" eyepiece **$25.00**

**Premium filters are currently the best in the world. All Lumicon filters include individually measured transmission data.*

DEEP-SKY ASTROPHOTOGRAPHY

SR-V 3200 NEW FILM

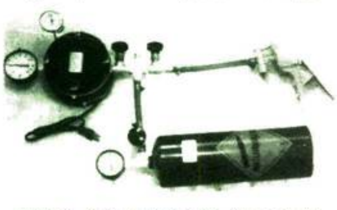
FILM HYPERSENSITIZATION KITS†

LUMICON HYPER-KITS™ yield 3-15x film speed gain in long exposures. They are safe & simple to use. Easy HYPER-KIT includes a chamber with all controls and fittings, thermometer, a refillable cylinder of non-flammable forming gas & hand-operated vacuum pump.

†U.S. Patent 4,473,636

MAKE YOUR OWN HYPERED FILM

MODEL 300 HYPER-KIT sensitizes any 35mm film in hours. Best for 2415. Achieves highest possible film speeds **$325**



MODEL 600 HYPER-KIT (See photo) Like the Model 300, but also sensitizes 120/220 larger format film and small glass plates **$395**

MODEL 1200 HYPER-KIT is for 4X5" plates and film up to 5X7". Has 2 gas cylinders and includes temperature controller ... **$595**

Temperature controller for any HYPER-KIT **$75**

Electric Vacuum Pump, Model R-10 **$325**

GUIDE OFF-AXIS FOR LOVELY ASTROPHOTOS

All **LUMICON EASY-GUIDER™** off-axis guiders† have both radial and 360° rotational adjustments for 5X easier guide-star selection, use 48mm filters, 360° camera rotation, large prisms for bright guide-stars. †U.S. Patent 4,448,500
Specify Camera and Telescope type.

NEWTONIAN EASY-GUIDER™

Full aperture. Installs in seconds. Specify 2" or 1¼".

NEWTONIAN EASY-GUIDER **$189.50**
48mm Coma corrector/field flattener .. **$285**
3X Relay Diagonal (see photo) **$99.50**
Illuminated reticle eyepiece, pulsed . **$109.50**
Guider for Hasselblad **$409,** Mamiya 645 **$199**
Pentax 6X7 **add $119;** Pentax 645 **add $139**

CASSEGRAIN EASY-GUIDER™

For C-8, Meade 2080, Cynamax-8. Includes 50mm achromatic lens for f/5.8 operation—3X shorter exposures! **Superb rich field viewing, too!**

CASSEGRAIN EASY-GUIDER **$249.00**
Adapter for Hasselblad **$225,** Mamiya 645 **$98**
Pentax 6X7 **add $119;** Pentax 645 **add $139**

GIANT EASY-GUIDER™

For Celestron-11, C-14, and the 10" Meade 2120. Includes 80mm clear aperture achromatic lens for edge-to-edge illumination & pin-point star images. F-ratio adjustable f/4-f/11. **Also yields unmatched Rich-Field viewing.**

GIANT EASY-GUIDER **$395.00**
48mm DEEP-SKY Filter ordered with any EASY-GUIDER (SAVE $20) ..... **add $99.95**
Adapter for Hasselblad **$295,** Mamiya 645**$149**
Pentax 6X7 **add $129;** Pentax 645 **add $149**

WHAT DO YOU NEED?

1. Illuminated reticle eyepiece **$99.50**
Lumicon 12mm eyepiece system has adjustable LED illumination, dual crosslines, battery pack.

2. Cable release for long exposures .. **$9.95**

3. **LUMICON Digital Drive Corrector** . **$249**
Dual-axis drive corrector is essential for astrophotography and/or field use of your telescope. 30Hz/90Hz variable output controls telescope drive. 60Hz digital reference ±12VDC Declination control output. Both 110VAC and 12VDC input for home or field use. Dec. reverse switch for Newtonians.

Declination motor (state telescope) ... **$109**
Variable dec. speed drive w/built-in 5AH battery **$299**

HYPERSENSITIZED FILM

Kodak
SR1600
Scotch
1000
NEW
SRV3200

YES! WE STILL HAVE FUJI HG400!

LUMICON Hypersensitized film is essential for good deep-sky astrophotography. Deduct 10% for 3 or more rolls (mixed o.k.). ***No C.O.D.s.***

Film Type, 35mm	**Exposures**	**Price**
2415, *Ultra-fine B&W, red sens.*	36	$11.95
SR-G3200, fastest of all, color neg	24	$14.95
Kodak Ektar 1000 fast, fine grain	24	$12.95
Fuji HG400 fine grain color neg.	24	$14.95
Scotchrome 400, fast slide film	12	$12.95
Fujichrome RD100, fine grain slide	24	$12.95
D-19 B&W Developer	1 gal.	$6.95

LUMICON® ACCESSORIES / MEADE® TELESCOPES

TOLL-FREE ORDER LINE 1-800-767-9576 EXPERT INFORMATION 1-510-447-9570 FAX 1-510-447-9589

LED FLASHLIGHT $14.95

LUMICON LUMILITE™ Red LED Flashlight

This red LED flashlight preserves night vision. It uses 2 AA cells (included!) which last 60-100 hours.

LUMILITE red LED flashlight	**$14.95**

DRIVE CORRECTORS

LUMICON UNITRAK DRIVE CORRECTOR

Operate your telescopes ***anywhere!*** Use the single-axis Unitrak with a 12V DC car battery. The dual-axis drives are for photography and use either 12V DC or 125V AC.

Unitrak™ single-axis corrector	**$99.95**
LUMICON DX200 dual-axis correc.	**$249.00**
DX2BP incl. battery & charger ...	**$298.00**

Convenient rechargeable Porta-Pac battery:

12V DC Porta-Pac (5AH) & recharger	**$79.50**
12V DC Porta-Pac (12AH) & recharger	**$99.50**

48MM COLORED FILTERS

FOR EVERY NEED

Select 48mm UV, Red, Yellow, Green (ea.)	**$20.00**
48mm Cyan (absorbs red)	**$69.00**
48mm High Performance Blue (95% T)	**$49.00**
48mm Tri-Color Blue (80% T- 400nm) .	**$49.00**
48mm Ultraviolet (85% T- 370nm)	**$49.00**
Color Separation Set: cyan, red, yellow, blue	**$149**

RICH FIELD! 2° in 8" SCT

NOW ONLY

$99.50

LUMICON Rich-Field Viewer on C-8 with LUMICON 2" star diagonal and 2" eyepiece.

The LUMICON Rich-Field Viewer fits **all** commercial Schmidt-Cassegrain telescopes. It has a high-performance coated achromatic focal reducing lens with 50mm clear aperture for **totally unvignetted viewing** with 2" or 1¼" eyepieces. It is available in several combinations depending on the eyepiece and field-of-view you desire (see chart below).

LUMICON Rich-Field Viewer	**$99.50**
Giant Rich-Field Viewer (10-14") ..	**$250.00**

Optional Eyepiece	**TRUE FIELD**	**Price**
Tele Vue 32mm Plossl	1.4°	**add $98**
Tele Vue 32mm 2" Wide-Field†	1.9°	**add $398**
Tele Vue 40mm 2" Wide-Field†	2.4°	**add $498**

†Includes 2" enhanced aluminum Star Diagonal (may not reach focus on some telescopes).

PROTECTIVE DUST COVERS

Protect your valuable telescope optics, eyepieces and accessories with these black vinyl covers. Add $1 shipping. Deduct 10%, 2 or more sets.

1¼" O.D. plug, seals focuser	**4/$2**		
2" O.D. plug	**2/$2**	3½" O.D. plug	**$1.50**
1¼", 1⅜" ...	**3/$2**	7½"	**$10**
1½"	**2/$2**	9½", 10.4"* ..	**$15**
2"	**2/$2**	12½", 12⅞"*	**$20**
2⅛"	**2/$20**	15.6", 16"* ...	**$28**
5½"	**$6**	19" (DS-16) ..	**$35**
*Fits Odyssey		21" (Odyssey-II)	**$35**

MEADE 8" - 16" LX200 SCHMIDT-CASSEGRAINS

8'' LX200
$2495
16'' LX200 $14,950

NEW Meade 8" LX200 Telescopes

LX100 - includes wedge, best for photography.
LX200 - full computer control w/64K obj. mem.

NOTE: A wedge is **not** needed for visual observing with the LX200 Drive. Select f/10 or f/6.3 (no extra charge) for your Schmidt-Cassegrain.

8" **LX100** with wedge ($105 P&S)	**$2095**
8" **LX200** w/computer ($105 P&S)	**$2495**
Wedge for photographing w/8" LX200 ..	**$139**
10" **LX100** w/super wedge ($145 P&S) .	**$2895**
10" **LX200** w/computer ($145 P&S)	**$2895**
12" **LX200** (f/10 only)($215 P&S)	**$3995**
Super Wedge for photogr. w/10",12" LX200	**$395**
16" **LX200** f/10 w/tripod ($385 P&S) .	**$14,950**
Dew Shields: 8" ..... **$119;** 10"	**$129;**
12" ..... **$189;** 16"	**$289**

OTHER SCHMIDT-CASSEGRAINS

Meade 2045D 4" f/10 w/motor ($40 P&S)	**$699**
Meade 2080B 8" f/10 w/tripod, wedge, MCOG ($95 P&S)	**$1249**
Model 2120B 10" f/10 w/wedge, tripod, MCOG ($125 P&S)	**$1599**

PHOTOGRAPHY ACCESSORIES

Cassegrain EASY-GUIDER 4", 8", f/6 or f/10	**$249**
Giant EASY-GUIDER for 10"/12" f/4-f/10 .	**$395**

MEADE STARFINDERS

New 8" f/6 Meade Starfinder telescopes

See the Meade ad in this magazine for full descriptions. These are complete telescope systems with motor drive (equat. only), mount, finderscope and 25mm (=48X) eyepiece.

6" **f/8 Dobsonian Starfinder** ($46 P&S)	**$325**
6" **f/8 Equat. Starfinder 6**(add $79 P&S) ...	**$599**
8" **f/6 Dobsonian Starfinder** (add $59 P&S)	**$425**
8" **f/6 Equat. Starfinder 8** (add $89 P&S) ..	**$699**
10" **f/4.5 Dobsonian Starfinder** ($85 P&S) ..	**$595**
10" **f/4.5 Equat. Starfinder 10** (add $99 P&S)	**$799**
12.5" **f/4.8 Dobsonian Starfinder** ($95 P&S)	**$795**
16" **f/4.5 Starfinder 16** (ship. freight COD) .	**$2495**

*All Starfinder telescopes shipped directly from Meade to the purchaser. Please add the indicated packing & shipping charge to the price. Slightly lower P&S for payment by check. LUMICON showroom prices are $99 higher.

ACCESSORIES

LUMICON carries all Meade accessories.

LUMICON Single axis drive corrector .	**$99**
LUMICON DX200 Dual-axis drive cor.	**$249**
Meade 47M Dual-axis drive corrector with tangent arm & electric declination ..	**$475**
LUMICON DX2BP Dual-axis drive corrector with built-in battery pack	**$299**

LUMICON® SKY VECTOR™

Higher Performance — Lower Price

LUMICON ACCESSORIES

LUMICON, 2111 Research Dr., #5, Livermore, CA 94550 (510) 447-9570 FAX (510) 447-9589

LOW PRICE—from $399

LUMICON SKY VECTOR FEATURES:

- "GUIDE" mode leads you to object
- Digital right ascension readout to 1 min.
- Digital decl. readout to 10 arc-min.
- 4000 pulse (0.09° accuracy) encoders
- Polar alignment ***not required!***
- Motor drive ***not required!***
- Just sight two stars to align!
- Works **equally well** for alt-azimuth telescopes like Coulter Odyssey and equatorial mounts like C-8, Meade 2080.
- **No need** to enter latitude, longitude, etc.

SKY VECTOR I™ $399

NEW! With over 220 object memory including the 110 Messier and 58 best NGC objects.

SKY VECTOR II™ $499

IMPROVED — Planets, Over 3,700 Objects! With size, magnitude and full visual description.

NGC SKY VECTOR™ $699

IMPROVED!—5500 Additions / Corrections

NGC-Sky Vector
OFF ON
DIM
MODE
ENTER
UP
DOWN
LUMICON

Improved NGC SKY VECTOR with over 12,000 object memory including the planets, complete, corrected RNGC catalogue, IC catalogue, P&K planetary catalogue, & much more!

Specify Telescope Type: Meade 2045, 2080, 2120, C-8, C-11, Odyssey 8, 10, 13, 17½, Alt-Azimuth.

Ultima 8, 11 .. **add $25**, C-14 .. **add $75**

COMA CORRECTOR

Coma 1 inch off-axis 17½" f/4.5

Same field with LUMICON coma corrector; smaller, more numerous stars.

This computer-designed LUMICON 2" lens reduces coma and flattens the field for both viewing and photography. **It threads into LUMICON 2" EASY-GUIDERS for effortless installation.** This zero power lens does not change image scale nor shift focus, and all lens surfaces are multi-coated for highest efficiency. Clear aperture = 1.8".

LUMICON 48mm Coma Corrector/Field Flattener Lens	**$285.00**
LUMICON 2" EASY-GUIDER .	**$189.50**
2" EASY-GUIDER (Mamiya 645)	**$199.50**
2" Adapter for Pentax 6X7	**$129.00**
2" Adapter for Hasselblad .	**$229.00**
2" Adapter for Bronica SQ-A	**$175.00**
2" Extension for viewing	**$26.00**

2" DELUXE BARLOW

1.8x Multiplier Lens (2" Barlow)

LUMICON 1.8x Multiplier Lens (2" Barlow)	**$235.00**

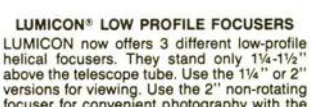
LARGE UV/DUST SEAL

Protect the optics of your 8-14" Schmidt-Cassegrain with a UV/Dust Seal. Simply thread it onto the rear cell, then attach all normal accessories. The large size fits Meade 2120, Celestron-11 and -14 & has a high quality multi coated (removable) 72mm UV filter.

Deep-Sky Filter/Dust Seal for C-8, 2080 ...	**$119.50**
UV/Dust Deal for Celestron C-8 ...	**$39.00**
UV/Dust Seal for Meade 2080, 2045	**$39.00**
UV/Dust Seal (large) for Meade 2120	**$89.50**
UV/Dust Seal for Celestron-11, -14 .	**$89.50**

LOW PROFILE FOCUSERS
New! Thread-on for Odyssey

FROM $69.50



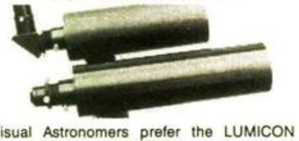
LUMICON® LOW PROFILE FOCUSERS

LUMICON now offers 3 different low-profile helical focusers. They stand only 1¼-1½" above the telescope tube. Use the 1¼" or 2" versions for viewing. Use the 2" non-rotating focuser for convenient photography with the LUMICON 2" EASY-GUIDER™.

Select your desired base-plate shape! Coulter Odyssey (thread-on installation), Flat, 7" OD, 9½" OD, 12½" OD, 16" OD, 21" OD.

LUMICON 1¼" Helical Focuser	**$69.50**
LUMICON 2" Helical Focuser 1½" high	**$75.00**
LUMICON Non-rotating Helical Focuser	**$129.00**
2" Astro Systems focuser, only 2" high	**$139.00**
3 handles for non-rotating focuser	**$12.95**
2"/1¼" **adapter** w/48mm filter threads	**$20.00**
2" LUMICON EASY-GUIDER	**$169.50**

LUMICON 50mm, 80mm SUPER-FINDER™



Visual Astronomers prefer the LUMICON 80mm SUPER-FINDER™, since hundreds of deep-sky objects, including most Messier objects, are visible directly. SUPER-FINDERS also make nice small portable telescopes. 80mm aperture, F=300mm coated achromat or 50mm, F=200mm coated achromat. Eyepieces and/or star diagonal are extra.

1¼" 50mm Finderscope **$59.50**, right-angle	**$59.50**
1¼" straight-thru 80mm SUPER-FINDER .	**$179.50**
1¼" right-angle 80mm SUPER-FINDER ..	**$189.50**
1¼" right-angle version, w/star diagonal ..	**$239.50**
25mm Cross-hair 1¼" eyepiece (12X)	**$49.00**
Large mounting rings for 80mm Finder	**$55.00**
1¼" Star Diagonal **$49**, Mounting Brackets,	**$39.50**
1¼" 45° diagonal for correct left-right views	**$59.50**

LOTS OF ADAPTERS

2" adapter for C-8, Meade 2080, etc. ..	**$29.50**
2" adapter for C-80, C-100 refractor ...	**$39.50**
2" adapter for C-70, C-80F, C-100F fluorite	**$39.50**
2" adapter for C-6, Comet Catcher, Meade 312	**$30.00**

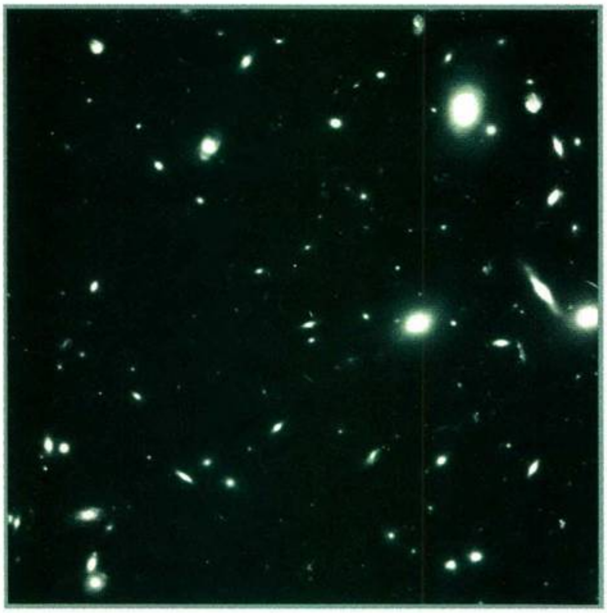
EXTENSION TUBES

1" long 1¼" OD thread-in extension ...	**12.00**
2½" long extension (holds 1¼" filters) .	**19.50**
4½" long extension for 1¼" eyepieces	**$25.00**
3" long extension for 2" eyepieces* ..	**$26.00**
2" long extension for 2" eyepieces* ..	**$26.00**

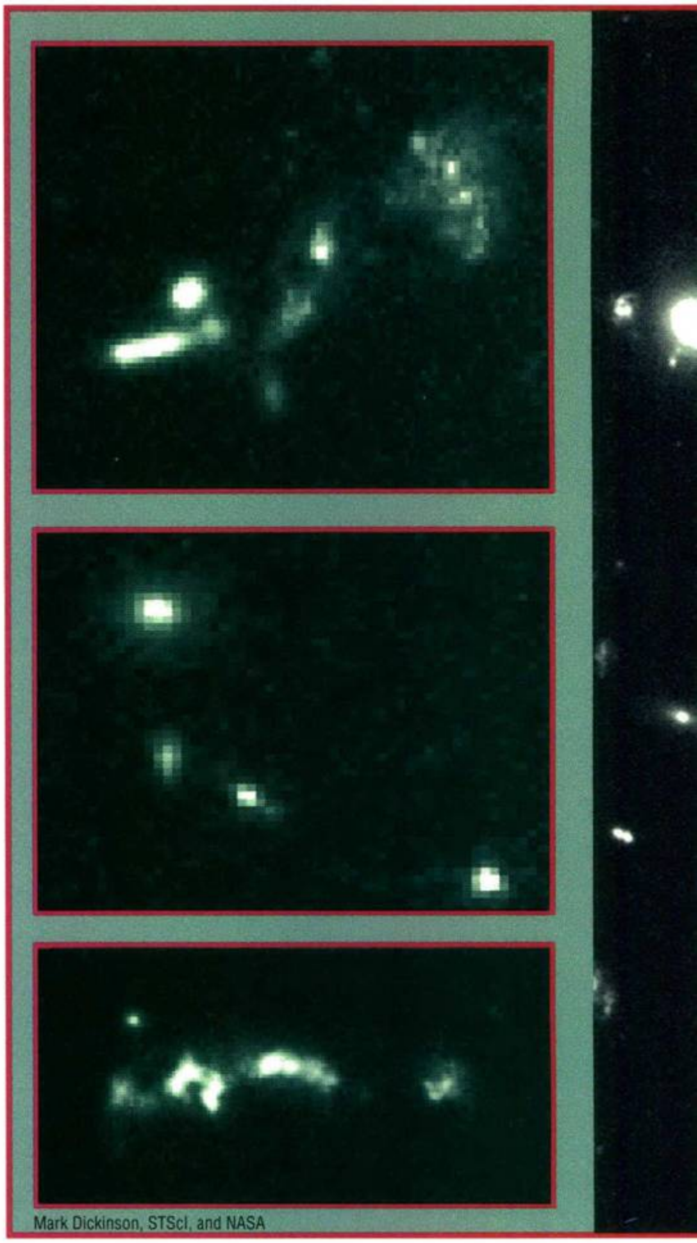
VIEWING ADAPTERS

2"/1¼" reducing bushing, threaded 48mm*	**$25.00**
2"/T-thread adapter, threaded 48mm* ..	**$25.00**
T-thread/1¼" adapter	**$25.00**
F/10 2" or 1¼" eyepiece viewing adapter for Giant Easy-Guider	**$39.50**
Low profile star diagonal eyepiece holder	**$16.00**
Meade 2" Diagonal/Giant Easy-Guider	**$39.50**

**Threaded to hold 48mm filters.*



Alan Dressler, Carnegie Institution, and NASA



Mark Dickinson, STScI, and NASA

Galaxy Time Machine

The Hubble Space Telescope looks back 12 billion years, showing how galaxies have changed since the dawn of the universe.

by David J. Eicher

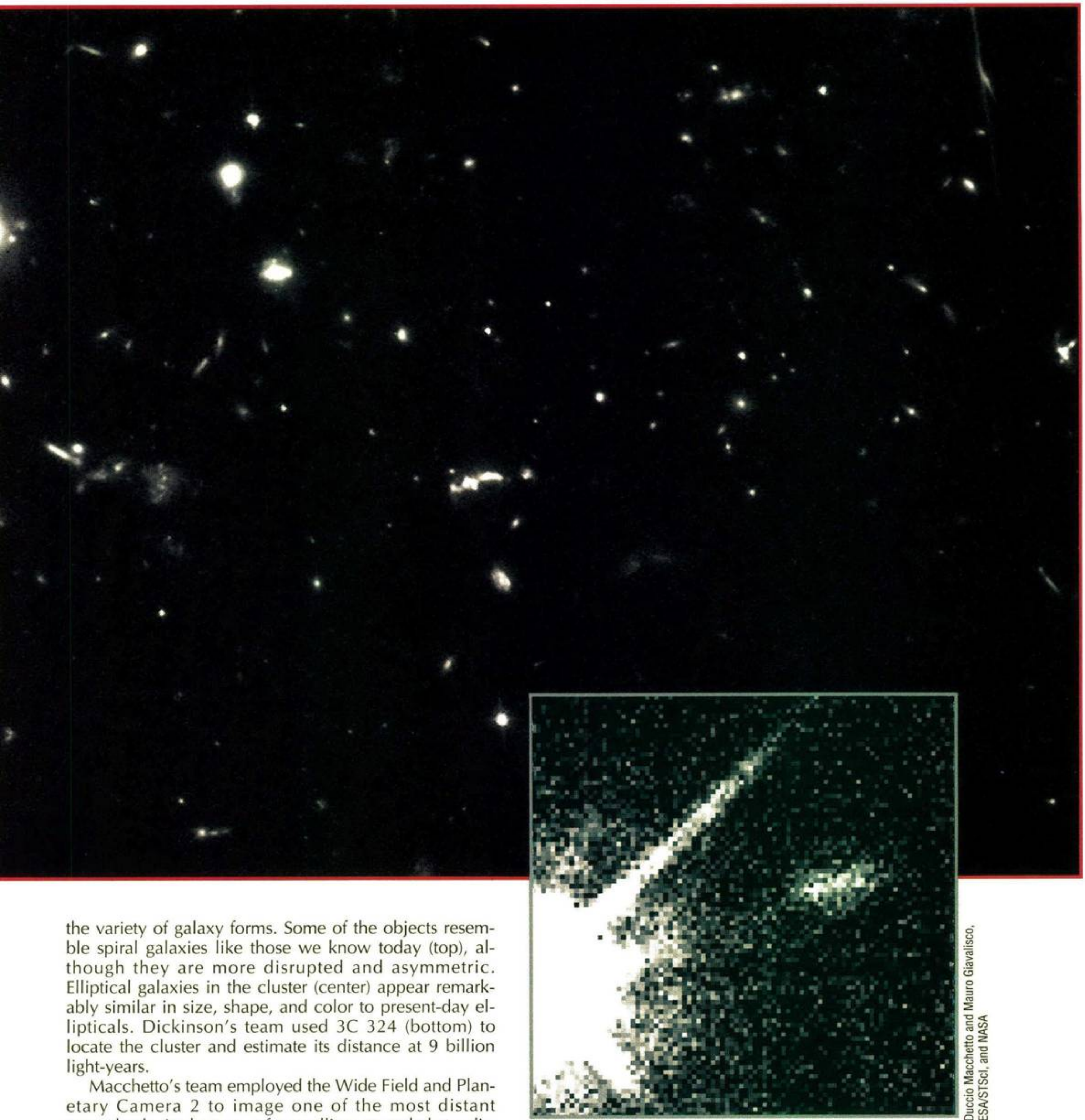
In today's universe we see two main types of galaxies, spirals and ellipticals. But new images made with the Hubble Space Telescope by three research teams show a dramatically new and different picture of how galaxies have evolved since the early days of the universe. The teams announced their results in a press conference at NASA's Goddard Space Flight Center in Maryland on December 6, 1994. Astronomers expect the ramifications of their results to echo for months throughout the world of galaxy research.

"The researchers have a remarkable finding in that elliptical galaxies reached a final condition relatively shortly after the Big Bang," says Goddard's Stephen P. Maran. "By contrast, spirals seem to have taken forever to get going."

The finding was unearthed by the three teams, led by Alan Dressler of the Carnegie Institution of Washington and Mark Dickinson and Duccio Macchetto, both of the Space Telescope Science Institute. Dressler's team used deep imaging with Hubble's Wide Field and Planetary Camera 2 to reveal galaxy forms 5 billion light-years away in the cluster CL 0939+4713 (above, left). This places them about a third of the way back to the Big Bang, assuming an age of the universe of 14 billion years, as did each of the teams. Dressler found abundant elliptical galaxies appearing as they do today but spirals with distorted features, which suggests encounters with other galaxies in the cluster, and mysterious "fragments" of galaxies in the cluster. "This is compelling, direct visual evidence that the universe is truly changing as it ages," says Dressler, "as the big bang model insists."

Dickinson's team also used the Wide Field and Planetary Camera 2. They pushed out to 9 billion *light-years* away (and back in time two-thirds of the way to the Big Bang) by making an 18-hour exposure over thirty-two orbits with Hubble. The resulting image of a galaxy field in Serpens near the quasar 3C 324 (above, right) contains stars and galaxies down to 29th magnitude.

"The image shows a cosmic zoo of fragmented objects," says Dickinson. "Again, we see normal looking elliptical galaxies and odd fragments of material that may be the forerunners to spirals like our Milky Way Galaxy." The three closeups from this image illustrate



Duccio Macchetto and Mauro Giavalisco, ESA/STScI, and NASA

the variety of galaxy forms. Some of the objects resemble spiral galaxies like those we know today (top), although they are more disrupted and asymmetric. Elliptical galaxies in the cluster (center) appear remarkably similar in size, shape, and color to present-day ellipticals. Dickinson's team used 3C 324 (bottom) to locate the cluster and estimate its distance at 9 billion light-years.

Macchetto's team employed the Wide Field and Planetary Camera 2 to image one of the most distant normal galaxies known, a fuzzy ellipse recorded at a distance of 12 billion light-years, sitting next to the bright quasar Q 0000–263 (right, inset). The image constitutes a glimpse of the primeval universe 85 percent of the way back to the Big Bang. Macchetto's team sees many elliptical galaxies at this distance, and dynamical theory suggests elliptical galaxies require a billion years or so to form. That means the galaxies must have come together only a billion years after the creation of the universe. Ellipticals, simple in form and great survivors of the universe's game, apparently pop right out of the gate and change little over the course of billions of years.

Spirals, however, seem to change greatly. Hubble suggests their fragile forms require billions of years to take shape, and that perhaps they come together from the fluffy fragments visible in the images. The work of these astronomers will spark new and dynamic thinking — "Hey, that means the Milky Way was really different when our Sun formed, right?" — and lead to a revolutionary, systematic deep imaging of the early cosmos. Hubble as time machine? Hold on, we're in for an exciting ride. □

YOUR #1 SOURCE

FREE GIFT WITH EVERY ORDER!

INFORMATION HOTLINE 718-436-6262

MEADE'S ONLY AUTHORIZ

focus CAMERA & VIDEO

MEADE ADVANCED PRODUCTS

LX200 SCHMIDT-CASSEGRAINS

8"/10"/12" CALL NOW!!!

NOW WITH ONE ARC-MINUTE POINTING ACCURACY AND 64,350-OBJECT ONBOARD DATABASE AS STANDARD EQUIPMENT!

Meade 8", 10" and 12" LX200 models with standard equipment, High-Precision Pointing software, now automatically GO TO any input RA and Dec, or any object in the 64,350-object database, to appointing precision within one arc-minute! The Meade 64,350-object library includes an incredible array of phenomena, *more than 6 times the size of object libraries included with competing telescopes*—virtually a lifetime of deep-space study, even for the advanced observer. • Version 3.3 version software and high-resolution encoders in conjunction with the unique Meade SYNC command yield the most precise slewing ever offered.

• Precise object-acquisition which is obtainable during either altazimuth or equatorial operation allows you to do the following: Find and center an object in the field of a 4mm eyepiece • Place an invisible image on any commercially available CCD unit through CCDimaging everytime.

• Photo- graphing or imaging of faint objects as asteroids or comets and tracking their motion from night -to night now becomes practical—the observer never has to see the object—the LX200 will place the the object precisely within the telescopic field.

8" WEDGE
$110

10"/12" SUPER WEDGE
$396

ASTROSEARCH/200
$99.95

1206 FOCUSER
CALL

LX200 KEYPAD HOLDER
$35.00

LX200 8"
$2495

LX200 10"
$2895

LX200 12"
$3995

LX200 16"
CALL

STARFINDERS EQUATORIAL

- **Superb Optical System**
- **Precision Equatorial Mount**
- **Electronic Motor Drive**

STARFINDER 6 6" F/8	**599.95**
STARFINDER 8 8" F/6	**699.95**
STARFINDER 10 10" F/4.5	**799.95**
STARFINDER 16 16" F/4.5	**CALL**
4500 NEWTONIAN	**CALL**

STARFINDER ACCESSORIES

#47M Dual Axis Drive Crctr	**IN STOCK**
Dust Cover for 6/8/10	**29.95**
#43 Drive Corrector	**88.50**
55 Dec	**79.95**

PICTOR SERIES CCD IMAGES

NEW!

For The Beginner, Or For The Most Advanced Observer, The Real CCD Revolution Is Here!

All models, including the least expensive unit, are simple to use. And yet, because of state-of-the-art Meade electronic & software design, this simplicity is accomplished simultaneously with the most advanced CCD image resolution and performance in the history of amateur astronomy.

#201 Autoguider/Imager	395
#208 Autoguider/Imager	795
#216 Autoguider/Imager	1195
#416 Autoguider/Imager	2495
#1616 Autoguider/Imager	6995
#616 Color Filter System	695

DOBSONIANS

NEW!

- **Primary & Secondary Mirrors Low Expansion Pyrex Glass**
- **Precision Rack-and-Pinion Focuser**
- **Rigid, Durable Beautiful Dobsonian Mountings**
- **Fully Adjustable 4-Vane Secondary Mirror System**

DOBSONIAN 6" F/8	**CALL**	DOBSONIAN 8" F/6	**CALL**
DOBSONIAN10"/F4.5	**CALL**	DOBSONIAN 12.5" F/4.5	**CALL**
DOBSONIAN 16" F/4.5	**CALL**		

ED APOCHROMATIC REFRACTORS

American-Made ED Apochromatic Refractors Feature An F/9 Doublet Design

152ED 6" F/9	**CALL**
127ED 5" F/9	**CALL**
102ED 4" F/9	**2195**
178ED 7" F/9	**5495**
#1664 Electronic Drive	**369**
#1697 Computer Drive	**695**
285 60mm Equatorial Refractor	**309**
390 90mm Altazim. Refractor	**CALL**
395 90mm Equatorial Refractor	**CALL**
227 60mm Altazim. Refractor w/2-1 1/4" Oculars	**CALL**

SPOTTING SCOPES

- **3 1/2" 1000mm F/11 Optics**
- **5x21 Erecting Image Finder**
- **45° Erecting Diagonal**
- **40x Meade Eyepiece**

MULTICOATED OPTICS LIFETIME GUARANTEE

97E w/Case	**332.95**
97ER Rubber Armored	**359.95**
2045S 4" SPOTTING SCOPE	**SPECIAL**
Carry Case for 97 E Series & 2045S	**49**

STANDARD SERIES SCHMIDT-CASSEGRAINS

2045D "The Truly Portable Scope"	**CALL**
Casr for 2045D75 Tripod & Wedge	**234**
Piggyback Bracket for 2045D	**15.95**
2080A "Perfect for the Beginner"	**CALL**
2080B w/SMC Multicoatings	**CALL**
2120A "Best Value 10-inch SCT"	**CALL**
2120B w/SMC Multicoatings	**CALL**
LX100R 8" NEW!	**CALL**
LX100 10" NEW!	**CALL**
8" Wedge	**110**
10" Wedge	**250**
#1205 Controller	**CALL**

EYEPIECES

SERIES 4000 SUPER PLOSSLS

Meade Super Plossls are the Finest General-Purpose Eyepieces Available All Multi-Coated

Super Plossls (SP; 4-elements: 1.25' 52°)

6.4, 9.7, 12.4, 15, 20, 26mm	**87.95**
32mm, 40mm	**109.95**
56mm (2")	**229.95**

SERIES 4000 SUPER WIDE ANGLE

Super Wide Angle (SWA; 6-elements: 1.25" 67°)

13.8mm	**159.95**	18mm	**169.95**	24.5mm	**199.95**
32mm (2")	**279.95**	40mm (2")	**39.95**		

The Ultimate Eyepieces Extreme Image Sharpness Over An Amazing 84° Field

SERIES 4000 ULTRA WIDE ANGLE

Ultra Wide Angle (UWA; 8-elements: 1.25 84°)

4.7mm	**179.95**	8.8mm (1.25"/2")	**269.95**
6.7mm	**219.95**	14mm (1.25"/2")	**329.95**

ILLUMINATED RETICLE EYEPIECES

SERIES 4000 PLOSSL 9MM 1.25"		**MA 12MM 1.25"**	
Without Cord	**149.95**	Without Cord	**99.95**
With Cord	**129.95**	With Cord	**79.95**

BARLOW LENSES & ACCESSORIES

#122 Doubles eyepiece power with sharp, high resolution, high contrast imaging on telescopes of all types 27mm dia. Excellent corrections for chromatic and spherical aberrations at all photovisual wavelengths. Multi-Coated 1.25 .... **47.95**

#126 Only 25" long, works with any 4. telescope excepting 1.25" eyepieces, even though with limited focus range. Multi-Coated 1.25" **47.95**

#127 Precision internal sliding lens assembly permits continuously variable power settings between 2x &3x. Engraved scale indicates power in use. Yields bright, sharp, high contrast images, on telescopes of all types. Multi-Coated 1.25" **59.95**

#140 2x Apochromatic The most advanced Barlow lens available for commercial telescopes; incl. 3-element, air-spaced optics, multi-ctd **79.95**

Camera Adapter .965"	**27.95**	1.25"	**29.95**
Variable projection Camera Adapter 1.25"			**39.95**
Basic Tele-Extender	**29.95**	Variable Tele-Extender	**39.95**
T-Adapter for SCT's			**26.95**
#927 45° Erect Image Diagonal Prism .965"	**49.95**	#928/1.25"	**49.95**
#929 2" Diagonal Mirror			**99.95**
#931 Hybrid Accepts 1.25" Eyepieces, Fits .965" Focusers			**49**

FILTERS

SERIES 4000 NEBULAR FILTERS 1.25"

Premium multilayer interference filters, the finest obtainable. Use broadband ("B") filters to block most forms of light polluton; use narrowband ("N") filters in heavy light-polluted areas or for extremely high contrast observing of faint nebulae.

BROADBAND FILTERS

#908B	**79.95**	#910B	**119.95**	#911B	**99.95**

NARROWBAND FILTERS

#908N	**89.95**	#910N	**129.95**	#911N	**119.95**

SERIES 4000 PHOTO-VISUAL COLOR FILTERS 1.25"

Made of purest crown optical glass, dyed in mass. For increased contrast and resolution on the Moon and planets. Fully coated. #8 Lt. Yel., #11 Yel-Green; #12 Yel; #21 Orange; #23A Lt. Red; #25 Red; #38A Dark Blue; #47 Violet; #56 Lt. Green; #58 Green; #80A Blue; #82A Lt. Blue .... **@14.95**

Moon Filter #ND96 Reduces Brightness by 87%	**16.95**
Set #1 4-Filters; #12, #23A, #58, #80A	**54.95**
Set #2 4-Filters: #11. #25A, #47, #82A	**54.95**
Set #3 4-Filters: #8, #21, #38A, #56	**54.95**

ED EAST COAST APD MAIL-ORDER DEALER

Telescopes

FOR ORDERS ONLY CALL: 800-221-0828 • FAX: 800-TO-FOCUS

CELESTRON

C8+/C8+ COMPUTERIZED

The C8+ and C8+ Computerized are the newest in the C8 family of 8" f/10 Schmidt-Cassegrains telescopes. Their design is sophisticated yet simple and fun to use. No complex bells or whistles to slow you down or interfere with operation. Set-up is quick with your C8+, leaving you time to enjoy yourself and your observing.

CLOSE OUT!

ULTIMA 8 PEC

The Ultima 8 PEC was completely redesigned to provide unsurpassed optical excellence, with superior mechanical and structural stability. A rugged, highly damped mount makes viewing and astrophotography a delight. Ergonomic, user-friendly operation is the trademark of the Ultma 8 PEC

PRICE TOO LOW TO PRINT

GG-11	CALL
GG-14 NEW!	FIRST COME, FIRST SERVE

ULTIMA 2000 8" & 11"

THE ULTIMATE IN SIMPLICITY & USER-FRIENDLINESS

Built-In Optical Encoders • 4-Motor Slewing
RS-323 Port • Autoguider
CCD Compatible • Portable and Rigid

CALL

C5/C5+

For astronomy on the go, the C5 can't be beat. Extremely portable, fits virtually anywhere from a compact car trunk to most airline overhead compartments. A serious, high quality precision instrument. The C5 was chosen by NASA for several recent shuttle missions.

SPECIAL!

FILTERS

Eyepiece Filters: 1-1/4"-#1A, #8, #12, #15, #21, #23A, #25, 38A, #47, #56, #58, #80A, #8A, #96ND,-50%T, #96ND-25% T, #96ND-13%T, Polarizing. . . . . CALL

PRECISION SOLAR FILTERS MOUNTED

BY THOUSAND OAKS OPTICAL

2"	61.90	3.1"	64.90	4 1/4"/5"	95.90	6"	104.90
8"	124.90	10"	138.90	11"	148.90	12.5"/13.1"	179

beattie INTENSCREENS

- INCREASED BRIGHTNESS
- EASIER TO FOCUS

CALL

TOP EAST COAST DEALER

WE'LL MEET & BEAT ANY LEGITIMATE PRICE!

NEWTONIANS

NEW! GP-C200 f/4 7.9" Reflector	IN STOCK!
C4.5 4 1/2" (114mm) Apeture Telescope	CALL
NEW! Firstscope 114mm (4 1/2") Reflector	CALL

REFRACTORS

		Firstscope 60EQ	*BLOWOUT*
GP-C102	CALL	GP-C102 ED	1950
Firstscope 60	*NEW! SPECIAL*	Firstscope 80	449

ACCESSORIES

Barlow Lens 2x 1.25"	62.95		
Counter Bar Weight Assembly 8"	5.95	11"	64.95
DEC Motor f/#935 16129 DEC Motor f/Classic	889		
DEC Motor f/C5+99.95 DEC Motor f/Classic	124.95		
Diagonal Star 1.25" w/Multicoating	44.95		
Digital Setting Circles-Advanced Astro Master	CALL		
Drive Corrector Heavy Duty	394.95		
Expanding Bushing .96" to 1.25"	49.95		
Finderscope 7x50	159.95	Focusmotor f/PEC's	139.95
MFFT-55	134.95	Micro Guide Eyepiece	159
Motor Drive f/C4.5	174.95	Motor Drive f/GP/SP	269
Multiple Holder 1.25"	145	Visual Back 1.25"	52.95
Photo Tripod Adapter	CALL	Piggyback Mount 8"	34.95
Piggyback Bar Assembly 11"	64.95		
Polar Axis Finder	89.95	Radial Guider	114.95
Radial Guider f/C5	119.95	Reducer Corr f/6.3	119.95
Reducing Bushing	49.95	Shoulder Mount	79.95
Tripod 8"	259.95	Tripod, Mini	34.95
Vibration Supression Pads	49.95		

EYEPIECES

PLOSSL 1-1/4"

7.5mm	CALL	10mm	CALL	17mm	CALL
26mm	CALL	40mm	CALL		

ULTIMA SERIES

5mm 1 1/4"	CALL	7.5mm 1 1/4"	CALL	1.25mm 1 1/4"	CALL
18mm 1 1/4"	CALL	24mm 1 1/4"	CALL	30mm 1 1/4"	CALL
35mm 1 1/4"	CALL	42mm 1 1/4"	CALL	60mm 2"	CALL

TeleVue

"Top In The Field"

NEW PANOPTIC Tack Sharp

15mm 1 1/4"	CALL
22mm 1 1/4"/2"	CALL
27mm 2"	CALL
35mm 2"	CALL

NAGLER Spacewalk Experience

NOW BY POPULAR DEMAND

12mm Type 2 1 1/4"/2"	CALL		
16mm Type 2 1 1/4"/2"	CALL		
20mm Type 2 2"	CALL		
4.8mm 1 1/4"	CALL	7mm 1 1/4"	CALL
9mm 1 1/4"	CALL	13mm 1 1/4"/2"	CALL

PLOSSL

7.4mm 1 1/4'	CALL	10.5mm 1 1/4"	CALL
13mm 1 1/4"	CALL	17mm 1 1/4"	CALL
21mm 1 1/4"	CALL	26mm 1 1/4"	CALL
32mm 1 1/4"	CALL	40mm 1 1/4"	CALL
55mm 2"	CALL		

WIDEFIELD

15mm 1 1/4'	CALL	19mm 1 1/4"	CALL
24mm 1 1/4"	CALL	32mm 2"	CALL

GENESIS-SDF KIT

Sky Tour Observing System **CALL**

PRONTO 70mm, E.D. Doublet, 480mm, f/6.8

Pronto w/2" Star Diag. 70mm f6.8 ED Glass &21mm Plossl	CALL
Pronto with Amici prism & 21mm Plossl	CALL

BINOCULARS

CELESTRON

HOW TO CHOOSE BINOCULARS	6.95		
7X42 Ultima	189	7x50 Ultima	249
8x32 Ultima	185	8x56 Ultima	279
10x42 WA Ultima	225	10x50 Ultima	259
11x80 MC.	329	15x80 MC.	CALL
20x80 MC.	CALL	12x80 MC *NEW!*	CALL

CELESTRON SPOTTING SCOPES

C90 All Models Including 1.25", C5 5", 500/5.6, C8	CALL

SWAROVSKI OPTIK

SPOTTING SCOPES		EYEPIECES	
AT-80	CALL	ATO-20-60x	CALL
AT-80 HD (Angled)	CALL	ATO-15X,22x & 33xWWX	CALL
ST-80 HD (Straight)	CALL	**SLC SERIES**	
SL SERIES		*NEW*! B7x30B MK II	CALL
B7x50 Blk, Blue, Green	CALL	*NEW*! B8x30 WB MK III	CALL
B8x56 Black, Green	CALL	B7x42 WB Black, Green	CALL
B10x50 Black, Green	CALL	B8x30W MK III Green	CALL

FUJINON

7x50 FMT-SX w/Carry Case	399.95
7x50 FMTR-SX Rubber Armored	415.95
7x50 FMTRC-SX Armored w/Compass	489.95
10x70 FMT-SX w/Carry Case	479.95
16x70 FMT-SX w/Carry Case	509.95

Nikon SPORT OPTICS

You'll Never See Things Quite The Same Again!

STAYFOCUS PLUS SERIES

7x35 RC	89	7x50 RC.	109.95	10x50 RC	110

CRITERION SERIES

7x35 E	259	8x30 E	275	10x35 E.	309
10x70 IF	699	10x70 HP IF	899		
10x50 Lookout	109.95	7x50 IF SP Prostar WP	689.95		

SPOTTING SCOPES

Fieldscope ED Body W.	540
Fieldscope ED II Angled Body W.	599
Fieldscope ED II 78mm	919.95
Fieldscope ED II 78mm Angled	979.95

BAUSCH & LOMB

SPACEMASTERS

Spacemaster	138.95
Spacemaster Kit w/15-45 Zoom Eyepiece	238.95
Spacemaster ED Glass	293.95
Armored Spacemaster	157.95
Armored Spacemaster Kit w/15-45 Zoom Eyepiece	254
Discoverer	172.95

KONICA FILM KODAK

SRG 3200 24 Exp.	6.25	TMZ 3200 36 Exp.	4.50

JMI JIM'S MOBILE, INC.

NEXT GENERATION COMPUTERS

NGC-microMAX Computer only	219
NGC-MAX Computer only	499
NGC-miniMAX Computer only, multi-lingual	349

MOTOFOCUS

Celestron C-8.	88	Meade LX200.	82
Meade 2080, 2120 LX3	88	Meade LX5, LX6.	84
Meade ED Apochromatic	88	Meade Newtonian	88
Meade Starfinder	88	TeleVue Refractors	88

NGF FOCUSERS

NGF-S For Schmidt-Cassegrains (includes Motofocus)	249

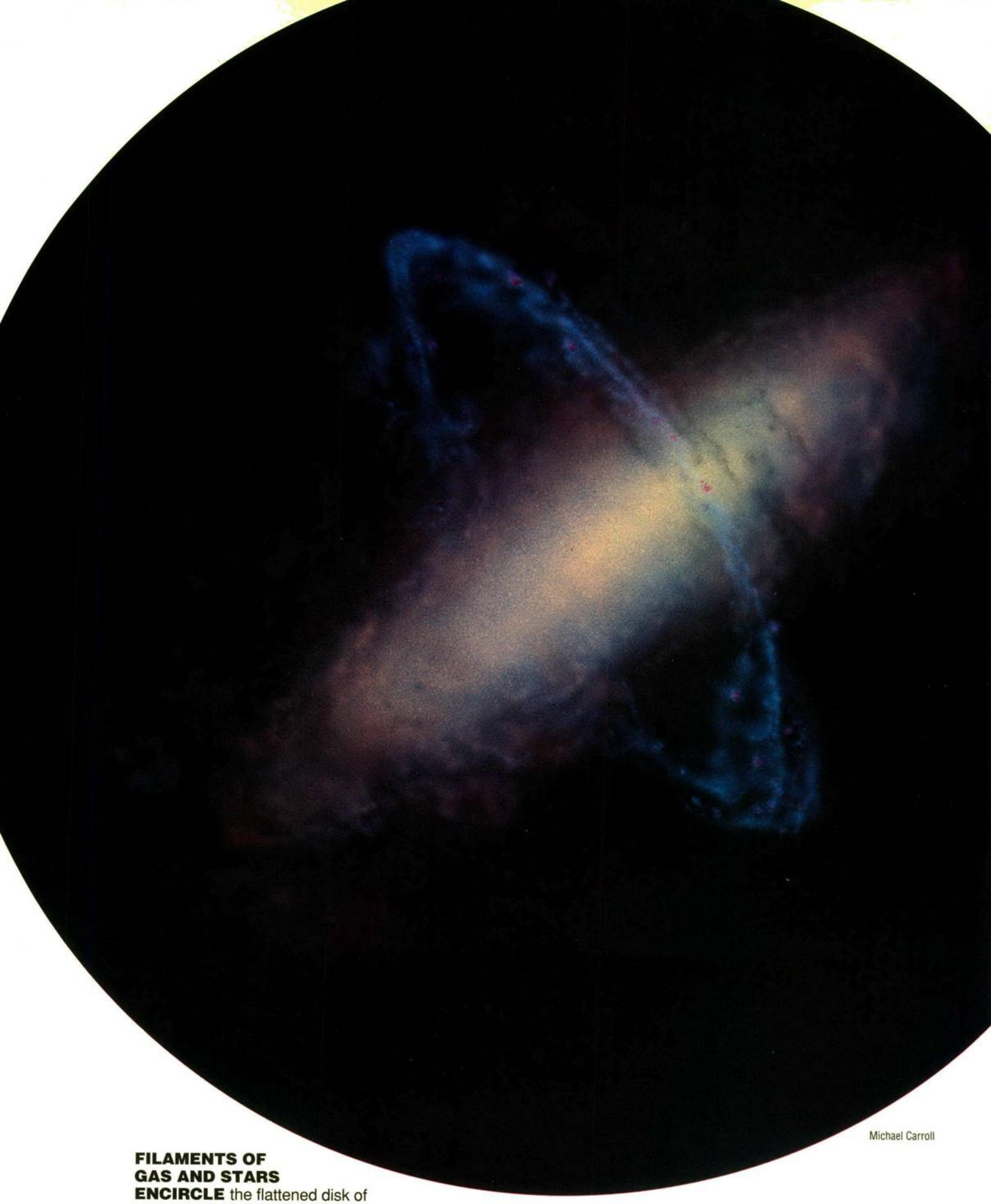
WHEELEY BARS

Meade Field/Celestron Ultima-All 2080/2120 fork mounts (except MTS) through LX200, Starfinder 6/8/10, LXD600/650, Celestron Ultima 8 Classic 8/C-8+/Super C-8 (with adjustable tripod)	94.95
Same as above with leveling	129

MOTODEC

Celestron C-8'	74	Meade 2045D, LX3	79
Celestron Great/Super Polaris	86		

THESE ADVERTISED PRICES ARE VALID MAR.1-MAR. 28, 1995 SUBJECT TO PRODUCT AVAILABILITY **focus camera, inc., 4419-21 13th Ave., Brooklyn, NY 11219** ORDERS ONLY CALL 800-221-0828 • INFORMATION & NY STATE CALL (718) 436-6262 ORDER STATUS & CUSTOMER SERVICE (718) 871-7608 • 24-HOUR FAX LINE (718) 871-1152 **Orders Shipped Promptly**-Most Major Credit cards, Money orders & personal Checks accepted for payment. COD orders are accepted but may require a deposit, personal checks may require up to 14 days to clear. All orders are subject to verification & acceptance. Shipping, handling & insurance are additional,please call/write for exact details. 14-day money back guarantee (less shipping) provided merchandise is returned in new condition, unused as received with papers & packaging intact. We gladly accept and reply to written or faxed inquiries. Not responsible for typographical errors. Ad prices available while supplies last. This ad supersedes all previous ads. Hours; Mon.-Thurs. 9-7, Fri. 9-2, Sun. 10-6.



Michael Carroll

FILAMENTS OF GAS AND STARS ENCIRCLE the flattened disk of a lenticular galaxy at a right angle to create a polar-ring galaxy.

ONLY SIX WITH RINGS

The origins of galaxies with perpendicular rings continue to confound astronomers. But at least they are beginning to reveal what their dark matter is made of.

by Sally Stephens

For years, the 11th-magnitude Helix Galaxy in Ursa Major was just one more odd-looking galaxy: a cigar-shaped collection of stars with faint filaments of gas, dust, and stars wrapped around its middle. But about a decade ago, astronomers learned that it not only looked odd, it really *was* odd. First they found that the central part is not the cylindrical bar it appears to be, but is actually a flattened disk of stars, seen edge-on. Then they discovered that the filaments don't circle the disk; they actually move in an orbit that passes over the poles of the galaxy. Classifying this galaxy required a new label — polar-ring galaxy.

Unmasking the first polar-ring galaxy hasn't led to an excess of discoveries. Observers know of only six such galaxies: the Helix Galaxy (NGC 2685), NGC 4650A in Centaurus, UGC 7576 in Coma Berenices, UGC 9796 in Bootes, ESO 415–626 in Fornax, and A 0136–0801 in Cetus. A recent survey by Bradley Whitmore of the Space Telescope Science Institute in Baltimore, Maryland, and his colleagues identified close to a hundred additional candidates, but confirming their identity will require more study.

While researchers search for more candidates, they continue to be surprised by what they learn about polar-ring galaxies. The unique tilt of the rings allows observers to probe the gravitational fields of these galaxies. Knowing the shape of the fields reveals how invisible matter is spread through the galaxy and, more important, the nature of the matter. This insight alone into the form of dark matter, which makes up 90 percent of the mass of the universe, gives polar-ring galaxies far greater importance than their small number would suggest.

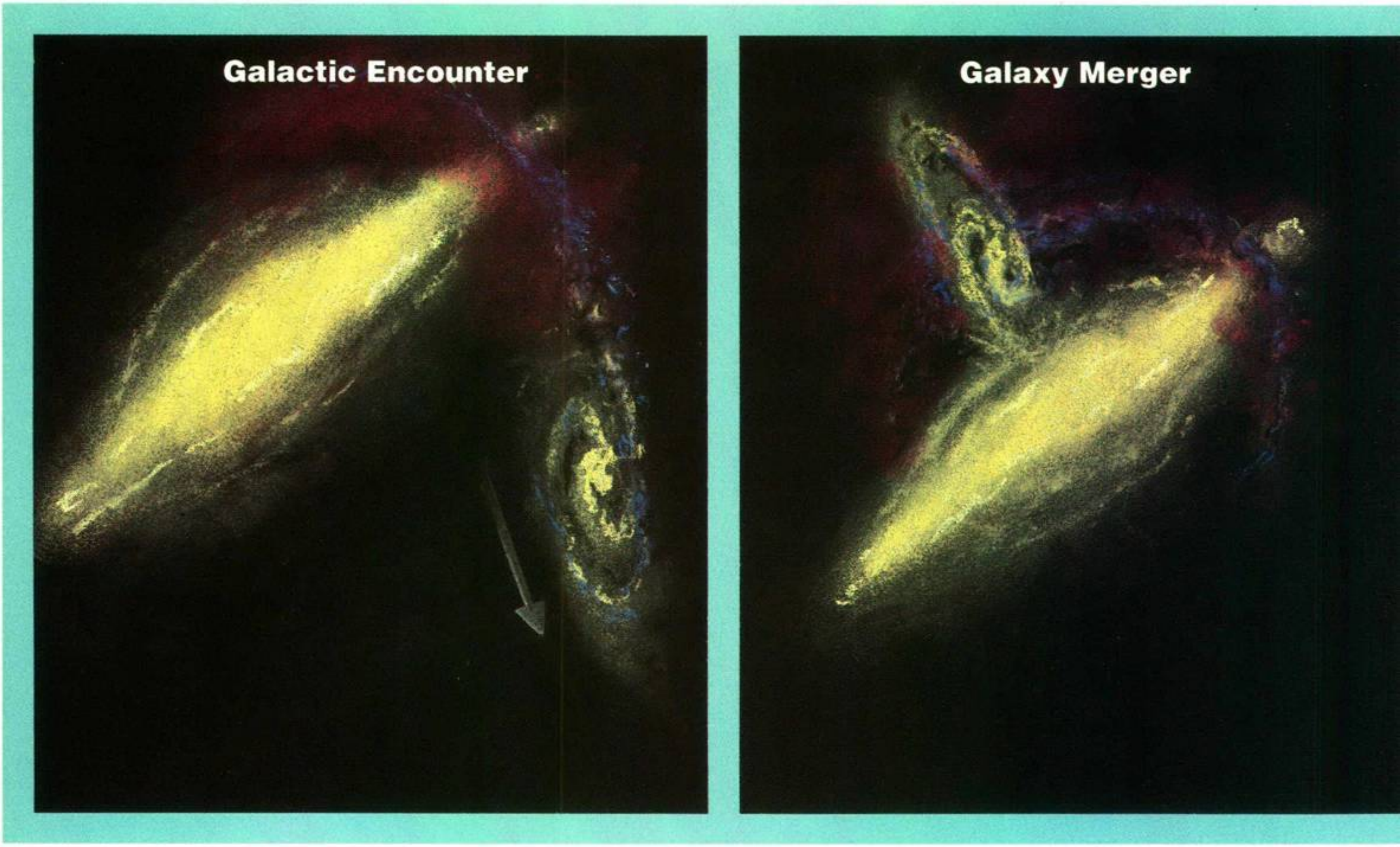
Researchers are also slowly beginning to learn how the polar rings formed and how old they are. Most astronomers agree it's nearly impossible for a polar ring to form at the same time as the galaxy at its center. The collapse of a giant gas cloud into a galaxy should leave all the gas and stars rotating in one plane, not two perpendicular ones. So scientists conclude that polar rings must have formed after the central galaxy formed as a result of some later event and suggest three possible mechanisms.

The first is capture. The theorists originally imagined that two galaxies passed close to one another, with one pulling a little gas and dust away from the other. If the galaxies passed at nearly a right angle, the stripped gas and dust would be trapped in a polar orbit around the more massive galaxy.

At first, because the rings are faint and seemed to contain relatively few stars, researchers thought they probably didn't contain much material. But observations made at radio wavelengths since 1987 show that the rings hold much more gas than first believed and are much larger than they appear in visible light. In fact, the amount of hydrogen gas in polar rings is about three billion times that contained in the Sun, about the same amount of gas normally found in an entire spiral galaxy. And that's not counting the mass of stars in the ring.

"If you want to believe that a polar-ring galaxy captured [the ring] material from another galaxy, you'd have to believe that it managed to strip off all of the gas of a large spiral galaxy," says Penny Sackett, an astronomer at the Kapteyn Astronomical Institute in the Netherlands and the Institute for Advanced Study in Princeton, New Jersey. But given that the central body in a polar-ring galaxy is not very massive, typically smaller than our own Milky Way Galaxy, it's hard to understand how it could strip so much material from a larger galaxy. "How was it able gravitationally to convince this gas to leave the environment of the more massive spiral and take up instead with this little polar-ring galaxy?" Sackett asks. "That's hard for us to understand."

A second possibility is the capture of an entire galaxy. The gravitational encounter would disrupt the



captured galaxy and spill enough of its gas to form a polar ring. Astronomers see galaxy mergers throughout the sky. But the usual candidates for capture, dwarf galaxies (typically only a few thousand light-years across) and large elliptical galaxies, don't have enough gas to create the observed rings. Large spiral galaxies do have enough but it's hard to imagine them being torn apart by the smaller polar-ring galaxy.

Sackett and her colleague Linda Sparke, from the University of Wisconsin in Madison, have proposed that polar rings formed from gas floating loose within a small group of galaxies. "Polar-ring galaxies very often have companions," Sackett explains, "although they're not in really dense clusters." The gas may never have been attached to any of the three or four galaxies in each small group. Or perhaps the gas in the member galaxies was pulled into intergalactic space during repeated close encounters between them. In either case, clumps of gas falling toward the poles of the polar-ring galaxy could stay in a polar orbit. "This is purely a hypothesis at this point, but many of the other theories don't seem to be working very well," Sackett admits. To follow up this idea, Sackett and her colleagues soon will begin looking for evidence of faint, very diffuse intergalactic gas in extended regions around polar-ring galaxies.

At this time, they aren't sure which of the several theories of polar-ring formation are correct. "My guess is that you probably make them all those ways," says Tom Steiman-Cameron, a researcher at the NASA Ames Research Center near Mountain View, California.

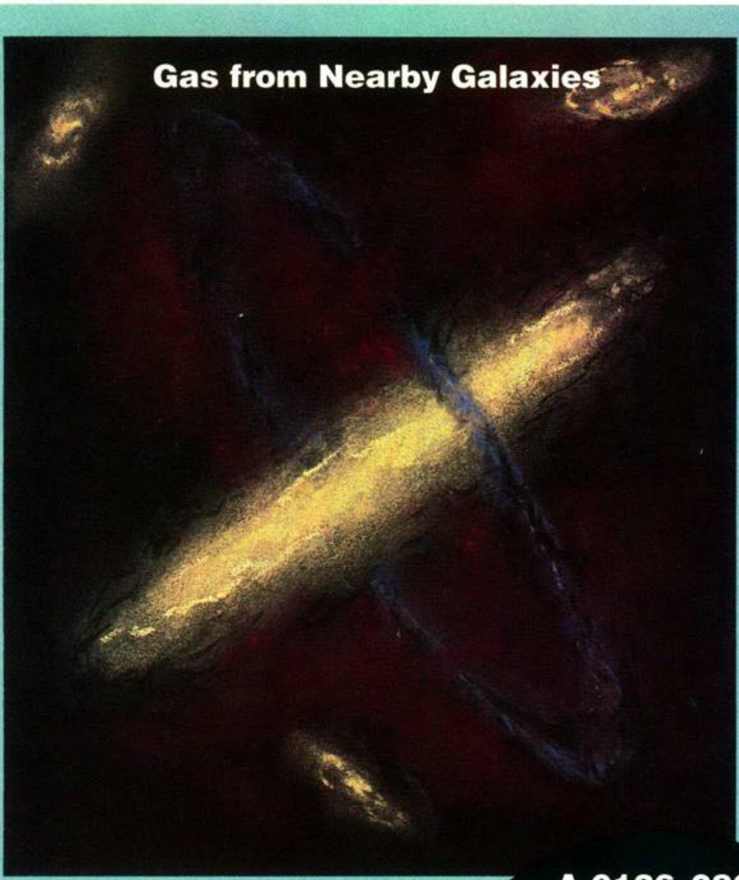
How these galaxies formed a ring is one question occupying astronomers' thoughts. How old they are is another. To answer that, researchers look at the stars in the ring. "The stars we see in the ring now are stars that formed after or during the process of forming the ring," Sackett says.

Clumps of gas existing before capture by the central galaxy collide with other gas during the capture, which changes their energies and orbits and causes them to settle into a disk or ring. Stars, on the other hand, do not collide with one another; their orbits are determined solely by their gravitational interaction with the central galaxy. Any stars existing before the capture would have their orbits diffused throughout the whole area, not concentrated into a ring. Thus the stars in the ring indicate the ring's age.

For a long time, astronomers thought polar rings were relatively young, because they appeared bluish. Stars that emit a lot of blue light have short lives so researchers assumed most, if not all, of the stars in the rings were young, maybe a billion years old or so.

But the blue color may be a false clue. "If you see a blue ring, all it really tells you is that the ring contains some very young, bright stars," says Sackett. "It doesn't necessarily mean that the ring doesn't have any old stars."

The old stars are typically faint and may be hidden by the glare of the young stars. But astronomers have a trick to uncover old stars. Older stars put out more of their energy at *infrared wavelengths compared to young* stars, so observers look in the infrared. Observations in the infrared also penetrate through the thick dust clouds



How Polar Rings Form

Astronomers haven't discovered how polar rings form around a galaxy but they have several ideas. Perhaps the least likely is the stripping of gas from a large spiral galaxy by a smaller lenticular. Although researchers can't rule this out, present models of how galaxies react when they encounter another galaxy have difficulty producing polar rings this way.

A more likely process is the capture of an entire galaxy. Galaxy mergers are common in the universe. In this case, the gravity of the lenticular would disrupt a spiral galaxy and spill its gas to form a polar ring. But most mergers involve dwarf galaxies, which have little gas to form a ring.

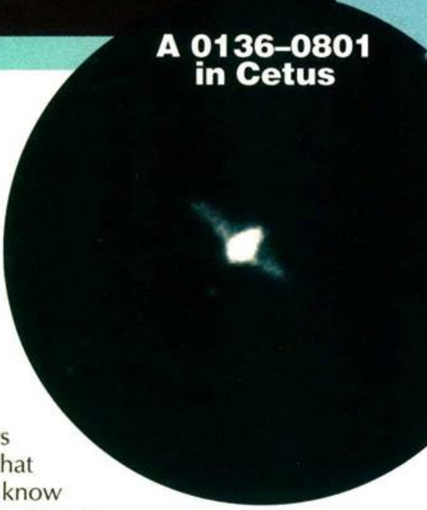
Another idea suggests that polar rings form from the gas floating within a small group of galaxies. The gas, left over from when the galaxies formed or stripped later from the galaxies, slowly falls onto the lenticular to form a ring.

in the polar rings, providing a better picture of where stars really are.

According to Sackett, observations made within the past year or two have detected the rings at infrared wavelengths, but astronomers need to complete their analyses before they can determine whether the detected light came from old stars or young ones. She suspects "that in the next year or two, we'll know something about the ages of the stars in the ring."

Knowing the ages of the rings leads to the next question: How long do rings last? "The older something is, the more likely it is that it's stable because it's been able to survive a long time," Sackett says. If nothing acts to stabilize the rings, material in the inner part will twist around the polar axis faster than material in the ring's outer part. After a while, it won't look like a ring anymore.

At this point, astronomers don't know for sure how long polar rings last. "I wouldn't be surprised if they last a fairly long time," Sackett ventures. She adds that when astronomers measure the motions of gas in different places on the polar ring, the gas is "doing pretty much the same thing on one side as it's doing on the other side." And orbits of material within the ring appear to be concentric around the ring's center. Both observations


A 0136–0801 in Cetus

Bradley Whitmore, STScI, et al.

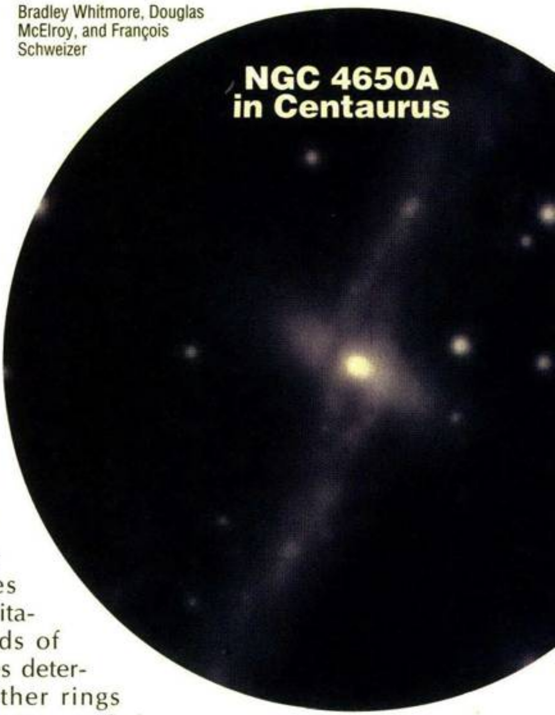
ESO 415–626 in Fornax

Bradley Whitmore, Douglas McElroy, and François Schweizer

Bradley Whitmore, STScI, et al.

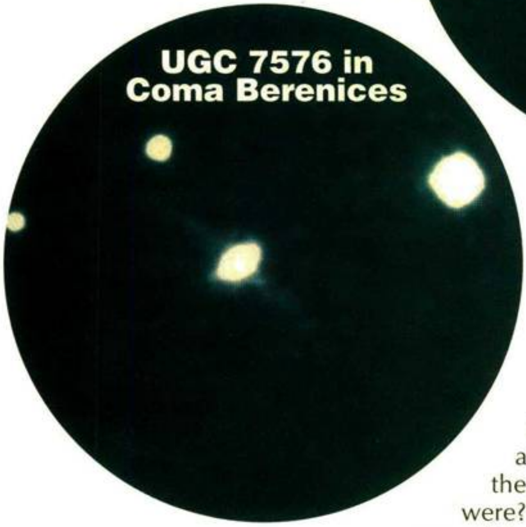
UGC 9796 in Bootes

Bradley Whitmore, Douglas McElroy, and François Schweizer



NGC 4650A in Centaurus

Bradley Whitmore, STScI, et al.



UGC 7576 in Coma Berenices

generally indicate stable motions within a ring.

"Will polar-ring galaxies evolve into something else with other galaxies taking their place?" Sackett wonders. "Or are [those] we see now the only ones there ever were?" Astronomers are not sure. What they do know is that as many as five percent of S0 galaxies (also called lenticulars because of their lenslike shape) may now have polar rings, or had one at some time in the past. S0 galaxies make up the central galaxies of all but one confirmed or suspected polar-ring galaxy (the oddball appears to be an elliptical galaxy).

"S0 galaxies are really fascinating creatures," says Steiman-Cameron. "In many ways they fall between the ellipticals and spiral galaxies." S0s, like spirals, have flattened disks of stars and, like ellipticals, they contain little gas.

Another question puzzling astronomers is, Why do primarily S0 galaxies seem to have polar rings? Apparently, a normal spiral galaxy can't have one because its gas lies in a disk. If you add a ring with lots of gas perpendicular to the spiral galaxy's disk, gas from the two systems will collide, tearing apart the ring. "You've got clouds [of gas] ramming into [other] clouds," Steiman-Cameron explains. "And BOOM! You'll have shocks. You'll form stars. But you won't keep a polar ring there. Collisions will destroy it fairly rapidly."

However, there are some elliptical galaxies that have rings of dust (and a little gas) orbiting their poles. Their rings are generally not luminous, but show up as a dark lane that blocks light from the underlying stars. And they are usually tight little rings, not much larger than the parent galaxy. Polar rings, on the other hand, shine by their own light and often extend far beyond the limits of the central galaxy. The two may be related. "Ellipticals that have a dust lane along the polar axis may be cousins of polar-ring galaxies," Sackett suspects. "That's another idea I think will be explored in the next few years."

Why do some S0 galaxies have polar rings and others none? Perhaps differences in the gravitational fields of the galaxies determine whether rings form. Astronomers gain information on the strength of a galaxy's gravitational field — and thus how mass is spread throughout the galaxy — by measuring the speeds of gas and stars as they orbit its center. Such measurements in spiral galaxies reveal large amounts of matter in their outer regions, where there appear to be few stars. Because astronomers can't see this matter directly, it has become known as dark matter. Even though this material is invisible to current telescopes and detectors, it has mass and affects the rest of the galaxy gravitationally.

Because the stars and gas in a spiral galaxy concentrate into a disk, measurements of their speeds only tell you about the gravitational field — and how matter is spread — in the plane of the disk. But the matter in a polar-ring galaxy isn't concentrated solely in a disk. "The fact that there's material in a very different place, above and below the plane of the galaxy, allows us to map out the gravitational force all over the galaxy," Sackett says. "And then we can use that to map out where the mass is in the galaxy and, in particular, where the dark mass is."

Sackett and her collaborators recently observed gas and stars in both the ring and central part of NGC 4650A and found that the halo of dark matter surrounding the galaxy has a flattened, not spherical, shape. "If you drew an oval that represented the shape of the dark matter halo," she explains, "the short axis would be about 30 to 40 percent the length of the long axis. That's pretty flat. It's interesting because that is about the shape of the central, luminous body. We don't know whether this is just a coincidence."

Sackett and her collaborator Rick Pogge, from Ohio State University in Columbus, have also found a flattened dark-matter halo in a second polar-ring galaxy, A 0136–0801. "I think that polar-ring galaxies probably provide the best evidence that the dark halos are not spherical, as people had previously assumed, but are substantially flattened," she explains. "They aren't in a really thin disk, but they are pretty squashed." She stresses,

NGC 2685 in Ursa Major

NOAO

however, the need to study more galaxies. "Unfortunately, these objects are rare. On average they're pretty far away and that means they're pretty dim. They're not easy things to study."

Knowing the shape of galactic halos will help astronomers better understand the nature of dark matter itself. An ongoing debate in astronomy is whether dark matter is like ordinary matter (called baryonic matter and containing ordinary protons, neutrons, and electrons) or whether it's made out of some previously unknown, exotic type of subatomic particle.

Some dark-matter candidates are more likely to settle into a flattened halo than others. For example, a spiral galaxy (made out of baryonic matter) is flat because its gas clouds interact with other gas clouds in the galaxy, lose some of their energy, and settle into a disk. On the other hand, Sackett asserts, "If [the halo is] more spherical, then the dark matter may have some other form, like a massive neutrino." Exotic particles don't interact with anything else so they can zip around in a sphere surrounding the galaxy.

Because of their orientations, polar-ring galaxies are perfect objects for studies of the shape of dark matter halos. So far, the evidence seems to favor considerable flattening, indicating that dark matter may be baryonic, but more galaxies need to be studied.

"[Dark matter in galactic halos is] one of the things that I work on a lot of the time," Sackett says, "and is one of my main interests in polar-ring galaxies."

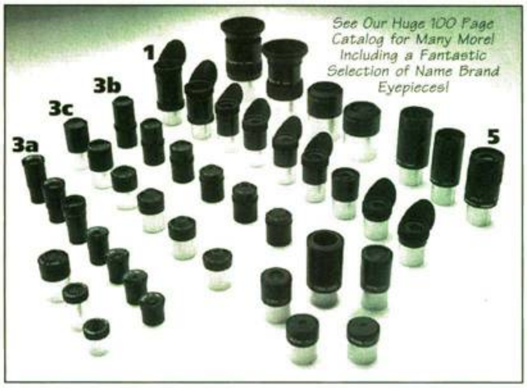
Astronomers have come a long way in their understanding of these unusual galaxies since they first realized ten years ago the importance of the Helix Galaxy and its polar-ring cousins. "I think that within a year or two, we're going to know the answers to a lot of the questions that we've been asking," Sackett claims, thanks to improved detectors, observations in different wavelength regions, and increasingly sophisticated computer models of interactions between galaxies. "But I'm sure the answers will raise other questions. They always do." ☐

Sally Stephens is a freelance writer living in San Francisco. Her last story for ASTRONOMY *was "Telescopes that Fly," November 1994.*

ORION TELESCOPE CENTER

THE WORLD'S LARGEST CATALOG OF TELESCOPES, BINOCULARS & ACCESSORIES FOR AMATEUR ASTRONOMERS

Eyepieces and Barlows



See Our Huge 100 Page Catalog for Many More! Including a Fantastic Selection of Name Brand Eyepieces!

1. Orion 5-Element Ultrascopic™ Eyepieces

With Superb, High-Performance Ultra™ Multi-Coatings!

Made for Orion by Japan's finest lens maker, Ultrascopic eyepieces yield the highest contrast, greatest light transmission and best overall image fidelity obtainable. With a superior 5-element design and Ultra™ Multi-Coatings on *every* surface, they achieve a level of performance "name brand" 4-element models can't match. Wide 52° flat field of view. Removable contoured rubber eyeguard. The 5mm and 3.8mm feature advanced 7-element designs which yield surprisingly long eye relief. Absolutely guaranteed to knock your socks off!

Medium-High Power 5-element

20mm #8566, **15mm** #8568, **10mm** #8570, **7.5mm** #8572 ***$89.95 ea.*** (3.45)

Wide Field 5-element

25mm #8564 ***$99.95*** (3.45)
30mm #8562 ***$119*** (3.45)
35mm #8560 ***$139*** (3.45)

***High Power 7-element** —Long Eye Relief*

5mm #8574 ***$109*** (3.45)
3.8mm #8576 ***$104*** (3.45)

5. UltraZoom™ 7–21mm

The finest zoom you can buy for your 1.25" telescope. For astronomy or terrestrial observing. 65°-35° field. Fully coated.

#8556 ***$179*** (3.67)

✧ Sirius™ Plössl 1.25" Eyepieces

Fantastic Name-Brand Quality Eyepieces at an Incredible Low Price!

You could pay nearly twice the price for "famous name" Plössl eyepieces, but we don't think you'll be able to tell the difference if you compare them to these fantastic eyepieces! Sirius Plössls are top-quality, 50° apparent field (43° 40mm) eyepieces with extremely sharp images of impressively high contrast. Ideal for all types of telescopes. The Classic 4-element Plössl design is renowned for its fantastic performance and has become the standard by which all other eyepieces are compared. The Fully Magnesium fluoride coated optics are mounted in precision black anodized aluminum housings with chrome-plated brass 1.25" barrels for durability and precision fit.

7.5mm #8738, ***10mm*** #8736, ***17mm*** #8734, ***26mm*** #8732 Reg. $58 ***Sale! $39.95*** (3.45)

40mm #8730 Reg. $80 ***Sale! $59.95*** (3.67)

Custom Field Case #5911 ***$12.95*** (2.19)
(Holds up to 4 eyepieces except for the 40mm)

SALE! $39⁹⁵ EACH! *(7.5mm-26mm)*
($59⁹⁵ 40mm)
Save $18-$20 each–*Any Quantity!*

3. Orion Explorer™ Multi-Coated 1.25" & .965" Eyepieces

These fine quality multi-coated eyepieces offer great performance at Orion's low direct-discount price. Black anodized, internally blackened, threaded for filters (except 40mm .965").

b *1.25" Orthoscopic*
5mm #8500, **7mm** #8502, **9mm** #8504, **12.5mm** #8506, **18mm** #8524, **25mm** #8526
$59.95 each (2.98)

c *1.25" Kellner*
6mm #8536, **9mm** #8538, **12mm** #8540, **18mm** #8508, **25mm** #8510, **40mm** #8512
$49.95 each (2.98)

a *.965 Orthoscopic*
5mm #8580, **7mm** #8581, **9mm** #8582, **12.5mm** #8583 ***$49.95 each*** (2.98)

a *.965 Kellner & Achromatic Huygenien*
K 18mm #8584, **K 25mm** #8585, **AH 40mm** #8586
$37.95 each (2.98)

Illuminated Reticle Eyepieces

12.5mm Plössl Illuminated Reticle 1.25"
Illuminator has fully adjustable brightness. Features double crossline reticle. Batteries included.
#8484 ***$119*** (3.45)

9mm Orthoscopic Illuminated Reticle 1.25"
Adjustable brightness illuminator. 'Bull's-eye within crosshairs' reticle. Needs 2 SR-44 batteries, not included.
#8488 ***$129*** (3.67)

12mm Kellner Illuminated Reticle 1.25"
Features double crossline reticle and red LED illuminator. Plugs into power panel drive bases.
#8482 ***$74.95*** (3.45)

12mm Kellner Illuminated Reticle 1.25"
Same as #8482 above except has a wireless illuminator. Needs 2 SR-44 batteries, not included.
#8481 ***$99.95*** (3.45)

Shorty™ Barlows

The short bodies allow extra versatility: provides 2x magnification when the eyepiece is inserted directly and 3x magnification when positioned before the diagonal on a refractor or SC. Will work in all telescopes, including those where longer barlows won't work.

.965" #8710 ***$44.95*** (2.98)
1.25" #8711 ***$54.95*** (3.45)

Barlow Lenses

Orion offers a large selection of barlow lenses, allowing you to double or even triple the power of your eyepieces, maximizing the versatility of your collection. Available in .965", 1.25" and 2" diameters.

Fully Baffled 2x Barlow
Multi-coated, with internal baffling to block transmission of stray light. Premium performance at a remarkable price.

.965" #8740 ***$39.95*** (2.98)
1.25" #8746 ***$46.95*** (2.98)
2" #8724 ***$89.95*** (3.95)

VariPower 2-3x Barlow
Allows you to adjust the magnification factor of the barlow by sliding the internal cell along a calibrated scale. Fully multi-coated optics. 1.25" barrel.
#8748 ***$59.95*** (3.45)

Filters

SkyGlow™ Light Pollution Filters

The finest available, SkyGlow™ filters from Orion make detailed deep-sky observing possible from light polluted city and suburban locations. Sophisticated multi-layer technology actually absorbs light pollution! Greater blocking and higher transmission than competitive models. See catalog for details.

SkyGlow UltraBlock Filters *(Visual Only)*
For severely light polluted areas and faint nebulae.

.965" UltraBlock Filter fits .965" eyepieces. #5655 ***$79.95*** (2.98)

1.25" UltraBlock Filter fits 1.25" eyepieces. #5654 ***$99.95*** (3.45)

2" UltraBlock Filter fits 2" eyepieces. #5657
SC UltraBlock Filter fits rear cell of Meade & Celestron SC scopes. #5656 ***$149 ea.*** (3.67)

Glass Solar Filters

High-quality optical glass filters, for superb images of the sun with your telescope. Triple-coated with advanced scratch-resistant stainless steel alloy. Great for both visual and photographic use. Slide fits over the front of your telescope.

For 8" SCs #7713 ***$144*** (4.05)
For 10" SCs #7715 ***$162*** (4.05)

NEW! *Solar glass filters for Deep Space Explorer reflectors. Many other sizes available—see our free catalog for details.*

SkyGlow Broadband Filters *(Photographic & Visual)*
For slightly to moderately light polluted areas.

1.25" Broadband Filter fits 1.25" eyepieces. #5660 ***$79.95*** (3.45)

SC Broadband Filter fits rear cell of Meade & Celestron SC scopes. #5658 ***$99.95*** (3.45)

52mm Broadband Filter For 52mm camera lenses, (Adapter rings available for other diameters.) #5668 ***$87.50*** (3.45)

2" Broadband Filter fits 2" eyepieces. #5659 ***$119*** (3.45)

.965" Broadband Filter fits .965" eyepieces. #5661 ***$49.95*** (2.98)

Moon Filters

Cuts 87% of the light from the Moon. Reduces glare by uniformly reducing light transmitted over the entire spectrum.

.965" #5664, **1.25"** #5662 ***$15.95*** (2.43)

Color Eyepiece Filters

Made from absolutely the highest quality photographic-grade precision-ground optical glass, anti-reflection coated. Ideal for contrast-enhancing planetary and lunar observations and photography with any telescope. The black anodized, machined aluminum cells thread into any standard eyepieces, or into our universal camera adapters.

.965" Set of 4 #80A Blue, #58 Green, #25 Red, #15 Yellow. #5510 ***$49.95*** (2.98)

1.25" Basic Set of 4 *#80A Blue, #58 Green, #25 Red, #15 Yellow. #5514*

1.25" Expansion Set of 4 *#21 Orange, #47 Violet, #11 Yellow-Green, #82A Blue. #5516*

1.25" Advanced Set of 4 *#8 Yellow, #23A Red, #38A Blue, #56 Green. #5570*

$54.95 ea. (2.98)

2" Set of 4 Includes #80A Blue, #58 Green, #21 Orange and #12 Yellow. #5513 ***$89.95*** (2.98)

Individual Filters
.965" & 1.25" ***$14.95***; 2" from ***$32.50***

Observing Aids

Eyepiece & Accessory Cases

With patented unbreakable latches, die-cut foam inserts. (Inside Dimensions shown)

Small Case (shown) 11"x7"x3" #5951 ***$17.95*** (2.78)

Medium Case 12.5"x9"x5" #5952 ***$26.95*** (3.36)

Large Case 16"x11"x5" #5953 ***$49.95*** (5.19)

Orion® FlexiShield™ Dew Caps

Forms into a tube with Velcro closure, opens flat for storage and travel. Models to fit most telescopes.

8" Celestron/Meade SC #4200 ***$44.95*** (2.98)

Other sizes available for scopes 3.5" to 14"—See our catalog for details.

Orion® Dew Zapper

Gently replaces lost heat, a sure-fire cure for dew problems.

8" Dew Zappers—fit all Meade & Celestron 8" SCs DC #3503, AC #3504 ***$47.95*** (2.98)

10" Dew Zappers—fit all Meade 10" SCs DC #3506, AC #3508 ***$54.95*** (2.98)

11" Dew Zappers—fit all Celestron 11" SCs DC #3510, AC #3512 ***$59.95*** (2.98)

Night Vision Flashlights

An essential accessory for astronomers. Choose from our wide selection.

Nitewriter Pen #5709	***$9.95***	(1.79)
Hands-Free Flex Light #5707	***$19.95***	(2.43)
Starlite LED Flashlight #5714	***$24.95***	(2.43)
Celestron LED Flashlight #5720	***$21.95***	(2.43)

Observer's Chairs

Standard Model—Adjustable hei center column and padded seat. #5935 ***$34.95*** (4.70)

Deluxe Model—Built for professional musicians. Extra heavy duty. #5934 ***$94.50*** (8.02)

Quality Components for Building or Upgrading

Parabolic Primary Mirrors

Excellent hand-figured parabolic mirrors guaranteed to meet theoretical limits of resolution. Fine polished, coated twice: with Aluminum and Silicon monoxide. Very competitively priced! *See catalog for pricing.*

Standard Primary Mirrors

Made from fine soda-lime plate glass, 1:8 thickness ratio. Guaranteed 1/8 wave. Sizes: 6" f/8, 8" f/6, 10" f/5.6, 12.5" f/4.8.

Pyrex Low Expansion Mirrors

Made from fine annealed Pyrex brand low expansion glass, 1:8 thickness ratio. Guaranteed 1/10 wave. Available with standard or 94% reflectivity Enhanced Aluminum coatings. Sizes: 6" f/5, 6" f/8, 8" f/6, 10" f/4.5, 10" f/6, 12.5" f/6.

Elliptical Secondary Mirrors

Made from fine annealed Pyrex brand glass, aluminized and SiO overcoated. Guaranteed 1/10 wave accuracy. Available with standard or high reflectivity Enhanced Aluminum coatings. Nine sizes from 1.00 to 4.00" minor axis.
See catalog for pricing.

6x30 Achromatic Finder Scopes

6x30mm—Same unit used on $1000+ "big name" telescopes. With 2-ring metal bracket, fits scopes 6"-12".
#13023 (white) ***$49.95*** (3.41)

6x30mm Right Angle—90° prism for right-angle viewing. Includes bracket.
#13021 (white) ***$79.95*** (3.41)

Large Aperture Finder Scopes

These are higher-quality finders at very reasonable prices! Fully coated wide field achromatic optics with adjustable focus. Precision crosshairs. White or black enameled metal tube. (Mounts sold separately.)

8x50mm—2.7x light grasp of 30mm models. Bright 6.25mm exit pupil.
#7090 (white) #7094 (black) ***$74.95*** (3.41)

8x50mm Illuminated—Wireless illuminator with adjustable brightness.
#7092 (white) #7096 (black) ***$109*** (3.41)

9x60mm — 44% more light grasp than 50mm models.
#7091 (white) #7095 (black) ***$109*** (3.41)

9x60mm Illuminated—Wireless illuminator with adjustable brightness.
#7093 (white) #7097 (black) ***$149*** (3.41)

Superb Dovetail Aluminum Mounts for 50mm and 60mm Finder Scopes

Instantly install or remove your finder, without tools, without disturbing alignment! Black anodized, fits any scope 6" and over including Celestron & Meade SCs. *(pictured above)*

8x50mm bracket #5040	***$37.50***	(2.45)
9x60mm bracket #5041	***$44.50***	(2.98)
Extra dovetail mounting plate #5050	***$12.95***	(2.19)

Low-Profile Helical Focusers

Economical yet precise focusing. Ideal for fast optical systems. Cast aluminum base with threaded machined aluminum inner tube.

1.25" #13014 ***$39.95*** (2.45)
2.0" #13016 ***$59.95*** (2.98)

Rack-and-Pinion Focusers

Finest in their class! Diagonal-cut plated brass racks, oversized knurled knobs, long focus travel.

1.25" #13007 ***$64.95*** (2.98)
2.0" includes 1.25" adapter. #13003 ***$109*** (3.95)

Visit One Of Our Three Unique Retail Stores

America's biggest & best selection of telescopes, binoculars & accessories. Now 3 convenient Northern California locations!
Some prices in retail stores may vary.

San Francisco
3609 Buchanan St., at Bay • **415-931-9966**
1 block from Marina Safeway

San Jose–Cupertino
10555 S. DeAnza Blvd., at McClellan • **408-255-8770**
From Hwy 280 take Cupertino exit, south 1.5 miles on DeAnza, from Los Gatos take Hwy 9 to Saratoga-Sunnyvale Rd.

Monterey Bay–Santa Cruz
2450 17th Ave., at Soquel, West Marine Bldg. • **408-464-0465**
From Hwy 1, take Soquel Drive exit.

ORION TELESCOPE CENTER
20th ANNIVERSARY
1975-1995

Fast SAME DAY shipping of in-stock items on phone orders received by Noon Pacific Time. Safe *Guaranteed* shipping to anywhere in the USA and Canada!

Quality Telescopes from Orion

Orion® Deep Space Explorer™ Dobsonian Telescopes

The best telescope choice in the universe for beginning amateur astronomers!

DEEP
EXPLORER
SPACE

6" and 8" Orion Deep Space Explorers

The ideal telescopes for beginning amateur astronomers! Acclaimed by experts & magazine reviews, these superb scopes are easy to use and show you more with their fantastic optics and smooth dobsonian mount. They include a precision low-profile focuser and fantastic 26mm Plössl eyepiece for no-compromise performance. (Shown with optional finder scopes.)

6" f/8 #9901 **$319** (39.00)
8" f/6 #9902 **$419** (49.00)

10" and 12.5" Deep Space Explorers

The large-aperture versions of our highly acclaimed series. Precision optics, superb 26mm Plössl eyepiece, low-profile 2" focuser (with 1.25" adapter), and fine dobsonian mount gives you incredible deep-sky AND planetary performance. (Shown with optional finder scopes.)

10" f/5.6 #9903 **$599** (69.00)
12.5" f/4.8 #9904 **$779** (79.00)

A. TeleVista II 60mm Refractor

Our better quality Japanese-made 60mm is equipped for preferred 1.25" eyepieces, includes a 25mm (28x) Kellner, all metal optical tube and yoke mount, finder scope, adjustable hardwood tripod, 1.25" diagonal prism, and slow-motion adjustment controls.

#9075 **$249** (8.97)

B. Sky Explorer II 60mm Refractor

Quality Japanese-made refractor with sturdy equatorial mount. Long 900mm f.l., larger 6x30 finder; prism-type star diagonal; 25mm (36x) and 9mm (100x) 1.25" Kellner eyepieces, setting circles; tripod; and lighted accessory tray.

#9076 **$429** (13.22)

C. Sky Explorer II 80mm Refractor

Fine quality Japanese-made refractor with 1200mm focal length, bigger equatorial mount, 25mm (48x) and 9mm (133x) 1.25" Kellner eyepieces, 6x30 finder, prism star diagonal, deluxe tripod and accessory tray.

#9077 **$699** (32.66)

D. SpaceProbe II 4.5" Reflector

Popular Japanese made 4.5" f/8 reflector, ideal for planetary and deep space. Equatorial mount, slow motion controls, setting circles. 6x30 finder plus 25mm (36x) and 9mm (100x) 1.25" eyepieces. Deluxe tripod.

#9078 **$469** (22.19)

Dozens More Telescopes in Our 100 Page Free Catalog!
C
D
B
A

Orion is Your #1 Source for Celestron Telescopes

CELESTRON

Observer 60mm Refractor

Great for viewing Saturn's rings, lunar craters, and distant earthly scenes. Compare our all-metal optical tube and mount, precision prism-type diagonal and quality 25mm (28x) Kellner eyepiece (.965" dia.), and hardwood tripod with models selling for much more!

#9079 **$144** (7.27)

Orion Binoculars for Astronomy

Orion 50mm Vista™ **SAVE $30**

Superb for long distance nature observation and astronomy. The image quality will amaze you even when compared to much higher priced binoculars. Fully multi-coated optics provide high-fidelity true color images without ghosting or other aberrations. Long 16mm eye relief and roll-back eyecups for eyeglass wearers. BAK-4 prisms. Weighs just 28 oz. Includes deluxe hard carrying case, rain shield, lens caps, and straps.

7X50 6.0° field of view #9355 Reg. $219 **Sale! $189** (5.19)
10x50 5.3° field of view #9353 **$219** (5.19)

50mm Explorer™ Binoculars

High performance, large diameter binoculars with BAK-4 prisms and multi-coatings. Great for both astronomy and daytime observation. Comfortable ergonomic body design.

7x50 #9306 **$129** (4.44)
10x50 #9308 **$134** (4.44)

Orion 50mm UltraView™

The perfect binocular for eye- and sunglass wearers. Extra-long 23mm eye relief and unique rubber pop-down eyepiece guard allows viewing with or without eyeglasses. Fully multi-coated optics. BAK-4 prisms. Wide 6.5° field of view. Close focus 16'. Weighs 32 oz.

10x50 #9351 **$169** (4.95)
7X50 #9357 **$179** (4.95)

7x50 Adlerblick Binoculars

Incredible wide-field eyepiece design. Fully multi-coated BAK-4 prisms make the 7x50 Adlerblick rival European brands selling for many times the price. 7° field of view, eye relief 26mm, exit pupil 7.14mm. Soft roll-down rubber eyeguards. Weighs 28 oz.

#9612 **$329** (5.28)

Orion® 8x56 Mini Giants

56mm objective lenses gather over 2.5x the light of ordinary 7x35 binoculars. Perfect for viewing faint celestial objects and daytime viewing. Multi-Coated BAK-4 optics. 6° field of view.

Standard Model #9504 **$159** (4.71)
Rubber Armored Model #9627 **$179** (5.07)

Orion Observer™ II 12x50

Extra-high power binoculars for long distance viewing. Fully coated optics provide sharp, clear images. Wide 6° field of view. Unique adjustable hand strap, built-in rubber eyeguards. Tripod adaptable. Weighs 25 oz.

#9645 **$119** (4.44)

80mm FMC Giant Binoculars

20% more light transmission than "fully coated"—Fully Multi-Coated optics and superior BAK-4 prisms provide fantastic contrast and greatly improved edge sharpness.

11x80 MC Brightest, widest field available. Ideal for deep-space observation under dark skies. Hand-holdable. #9502

16x80 MC 45% higher power, excellent for astronomy and daytime observation. Tripod recommended. #9496

20x80 MC Highest power model perfect for smaller deep-space objects and long range daytime views. Tripod required. #9498

$439 (8.05)

Orion® 70mm FMC Giants

The standard for hand-holdable astronomy binoculars. Fully multi-coated. Weighs only 58 oz., yet the same brightness and 7mm exit pupil as our 11x80 MC model. Superior 'BCF' body design. Includes tripod mounting adapter.

10x70 #9501, ***14X70*** #9494 **$339** (6.97)

SuperGiant™ 100mm Binos

Gigantic, almost 4" lenses gather 156% of the light of 80mm binoculars. Individual eyepiece focus, fully multi-coated optics and BAK-4 prisms. Tripod mounting plate, metal-clad case. Weight 7.5 lbs., height 13.5".

14x100 #9495, ***25x100*** #9497 **$1199** (14.00)

Orion Accessories

Call Toll-Free for Our Huge 100 Page Catalog and See Even More!

Orion Accessories are absolutely guaranteed to be the finest quality available. Compare them side-by-side with "famous name" products! We buy direct from many of the same sources, always specify the highest quality and pass along the savings to you! 100% satisfaction guaranteed!

Universal Camera Adapters

For prime focus or eyepiece projection astrophotography.

.965" #5268 **$27.95** (2.98)
1.25" #5264 **$29.95** (2.98)
Hybrid 1.25"/.965" #8782 **$29.95** (2.98)

Variable Power Camera Adapter

Allows variable projection distances during eyepiece projection photography. For 1.25" eyepiece holders.

#5262 **$39.95** (2.98)

Orion Slow Motion Adapter

Attaches to your photo tripod pan head. 2 slow motion control knobs to make precision adjustments in altitude and altazimuth. Very handy for tracking planets, the Moon, etc. with refractor telescopes and small spotting scopes. Attaches with a standard 1/4-20 thread.

#7033 **$36.50** (2.19)

Tele-Extenders for SC Scopes

For high powered photography with your Meade, Celestron 4", 8", 10", 11", 14" Schmidt-Cassegrain.

Standard Tele-Extender #5125 **$29.95** (2.98)
Variable Tele-Extender #5127 **$39.95** (2.98)

T-Adapters for SC and MAK

Threads to rear cell of telescope, requires t-ring for your camera model.

for SC #5116 **$26.95** (2.98)
for C-90 #7115 **$34.95** (2.98)

T-Rings for all 35mm Cameras

Available for many different camera types, call toll-free or see our catalog for your particular model.

A. 45° Erect Image Diagonal Prisms

Ideal for all refractors and compound telescopes used for terrestrial viewing.

Hybrid 1.25"/.965" Diagonal #8792
1.25" Diagonal #8790
.965" Diagonal #8791 **$44.95** (3.45)

B. 90° Star Diagonal Prisms

Orion's multi-coated diagonals are ideal for refractors and Schmidt-Cassegrains.

1.25" Star Diagonal #8763 **$49.95** (2.98)
.965" Star Diagonal #8761 **$29.95** (2.98)
Hybrid 1.25"/.965" #14008 **$33.95** (2.98)

D. Orion Ultra™ 2" Diagonals

2" Prism Diagonal–Absolutely the finest quality multi-coated 2" prism for highest light transmission.

For refractors #8770
For Schmidt-Cass. #8771 **$219** (4.71)

2" Mirror Diagonal– Affordable, high-quality first-surface optical flat star diagonal.

For Schmidt-Cass. #8772 **$109** (3.45)
For refractors #8773 **$109** (3.45)

Sky Wizard™

SAVE $50

On Any Sky Wizard when purchased with any telescope installation package!

Electronic Finder & Sky Catalog

Let Sky Wizard do the work, while you relax and have fun observing!

- Find any celestial subject in 15 seconds!
- One minute setup — no polar alignment or levelling.
- Observe hundreds of objects in a few hours!
- For ANY telescope, with or without a motor drive. *Even altazimuth or Dobsonian scopes!*
- Digital display of celestial coordinates (RA & Dec).
- Built-in electronic sky catalog — find subjects by their common catalog name, not their coordinates. Complete with object descriptions.
- Powered by a single 9v battery. Weighs just 6 oz!

Sky Wizard Model 1
Includes the Messier Deep Space Catalog of 110 objects, 28 bright stars, and the planets. #7801 **$199** (4.11)

Sky Wizard Model 2
Huge 2100+ object database, plus a user catalog to store 27 objects of your choice. #7802 **$319** (4.44)

Sky Wizard Model 3
Gigantic 10,000 object database, expanded subject descriptions, RS-232 port. #7803 **$469** (6.78)

Complete system requires Sky Wizard Model 1, 2 or 3 and a telescope installation package, sold separately.

Installation Packages
Includes 2 encoders, all required mounting hardware and brackets, connecting cables, and complete illustrated instructions.
Installation packages are available for most telescope models. Call for details.

starting at **$177**

Orion Off-Axis Guider

Allows you to observe a guide star during photography. Multi-coated.

#5144 **$74.95** (3.45)

Orion UltraGuider

Wide-range lateral prism adjustment; precision helical focusing; adjustable camera focal plane position. #5139 **$139** (4.19)

110v Motor Drive for Refractors

Fits Orion equatorial mounts, many others. Plugs into any standard AC outlet.

#17001 **$74.95** (3.95)

12 Amp Hour Porta Pac Battery

Ideal for high power-consuming accessories. With carrying case. Weighs only 10 lbs.

#2354 **$109** (8.97)

MONEY-BACK
If you are not completely satisfied with your purchase from Orion, for any reason,
100% Satisfaction
just return it in new condition within 30 days after delivery for a prompt refund.
GUARANTEE

IT'S EASY TO ORDER!

- Call toll-free and charge to your MasterCard, Visa or Discover Card or send your personal check to order by mail.
- California residents add 7.25% sales tax (8.25% in Santa Clara and Santa Cruz Counties, 8.5% in San Francisco).
- Shipping & handling charge for UPS Ground or US Mail to lower 48 United States are listed in parentheses after each price. We ship to U.S. and Canada only.
- We expected the prices in this ad to be accurate for March 1995 at the time of our advertising deadline in January 1995. Please call our toll-free number for current pricing and to receive our latest catalog. Prices are subject to change or correction without notice.

MasterCard
DISCOVER
VISA

ORION
TELESCOPE CENTER

2450 17th Ave., P.O. Box 1158-A
Santa Cruz, CA 95061-1158
When ordering, mention key code LMA
Business Offices (408) 464-0446

Call Toll-Free
800-447-1001

SKY ALMANAC

Highlights
by Rick Shaffer

Date	Event
13	Venus Greets Saturn's Return. . . . . . . *(p. 56)*
15	Taking a Bite out of the Moon . . . . *(p. 61)*
15	The Full Moon Occults Spica. . . . . *(p. 63)*
29	A South American Solar Eclipse. . *(p. 64)*
All month:	
	Observer's Challenge: Saturn's Moons in Eclipse . . . . . . *(p. 63)*
	Metis Passes Through the Leo Trio . . *(p. 64)*
	First Views: Explore the Virgo Cluster . . . . . . *(p. 65)*
	The Starry Sky: Virgo. . . . . *(p. 62)*

Two eclipses – a partial lunar and an annular solar – highlight a month that also sees Saturn return to the morning sky.

by Deborah Byrd

April is the month of opening blooms and sprouting buds as spring arrives in earnest in the Northern Hemisphere. The sky too takes on its characteristic look of spring: The bright grouping of winter stars and faint band of the winter Milky Way set early in the evening; the Big Dipper appears prominent in the northeast; and Leo, herald of the spring stars, lies high in the evening sky.

If you look westward after sunset early in the month, you'll see a young crescent Moon. It "blooms" in its own way, waxing or appearing more lit with each passing evening. By April 9 and 10, the Moon appears gibbous (more than half lit but less than Full), and it shines high in the south after sunset near a bright orange-red object, the planet **Mars**.

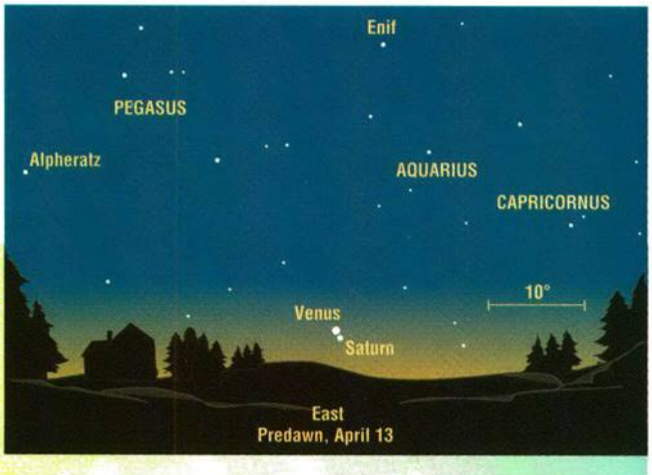
Mars is the only prominent planet in April's evening sky. It appears particularly conspicuous early in the month when it shines at magnitude –0.2. We are now moving ahead of it in our smaller and faster orbit around the Sun, having passed between it and the Sun back in February. Our distance from Mars grows over the course of the month by more than 20 million miles, so the planet fades noticeably in brightness, reaching magnitude 0.4 by April 30.

The telescopic view of Mars also worsens. When April begins, Mars' ruddy disk appears 10.4" across, still large enough to show many features in a backyard telescope. By month's end, though, Mars' disk has shrunk to 8.2" across and only the bright white north polar cap and the most distinct dark markings will be visible.

Earth now lies far enough ahead of Mars in its orbit around the Sun that Mars moves eastward in front of the stars. It begins the month in the constellation Cancer but crosses into Leo, the Lion, after midmonth. The stars in the lion's head and shoulders form a pattern shaped like a backward question mark. Called the Sickle, this grouping lies just east of Mars. The bright star at the bottom of the question mark is Regulus, or Cor Leonis, the lion's heart.

A triangle of bright stars located about 15° east of the Sickle represents the lion's

Venus Greets Saturn's Return



East
Predawn, April 13

Venus dominates the morning sky in April as it blazes at magnitude –4.0 early in the month and then drops imperceptibly to magnitude –3.9 for the rest of the month. A telescope reveals a 13"-diameter gibbous disk. Luckily for observers with telescopes, Venus rises after the onset of twilight, reducing the glaring contrast between the brilliant planet and surrounding sky.

During the first few days of the month, you should start noticing another bright object below Venus in the predawn twilight, Saturn. Although it is far dimmer than Venus, at magnitude 1.2 you should have little trouble picking it out.

Saturn climbs higher as the days pass, making a beeline toward its brilliant neighbor. By the morning of the 13th, the two pass within 0.6° of one another, their closest approach in more than three years. The proximity of the two affords a rare opportunity to compare the two objects. Surprisingly, Saturn, which normally appears much larger in a telescope than Venus, seems only a little larger this month. That's because its rings, which extend more than twice as far as the planet's globe, are nearly invisible this month. The 16"-diameter disk will be far more obvious than the 36"-diameter rings. And be sure to enjoy the contrast of the milky-white cloudtops of Venus with the subtle tans and browns of Saturn.

You'll want to pick an observing site with a good view toward the eastern horizon because both planets are quite low. And don't hesitate to follow them after sunrise. The seeing often gets better around the time the Sun rises, and it stays that way for a while. — *Rick Shaffer*

APRIL

1 Jupiter is stationary, 8 a.m. EST

5 The Moon is at apogee (251,639 miles from Earth), 6:09 a.m. EDT

8 First Quarter Moon is at 1:35 a.m. EDT
Asteroid Euterpe is at opposition

10 The Moon passes 8° south of Mars, 10 a.m. EDT

13 Venus passes 0.6° north of Saturn, 1 p.m. EDT (p. 50)

14 Mercury is in superior conjunction, 9 a.m. EDT

15 Spica is occulted by the Moon, 5 a.m. EDT (p. 57)
Full Moon is at 8:08 a.m. EDT; partial lunar eclipse (p. 55)

17 The Moon is at perigee (224,751 miles from Earth), 4:19 a.m. EDT

18 The Moon passes 3° north of Jupiter, 5 p.m. EDT

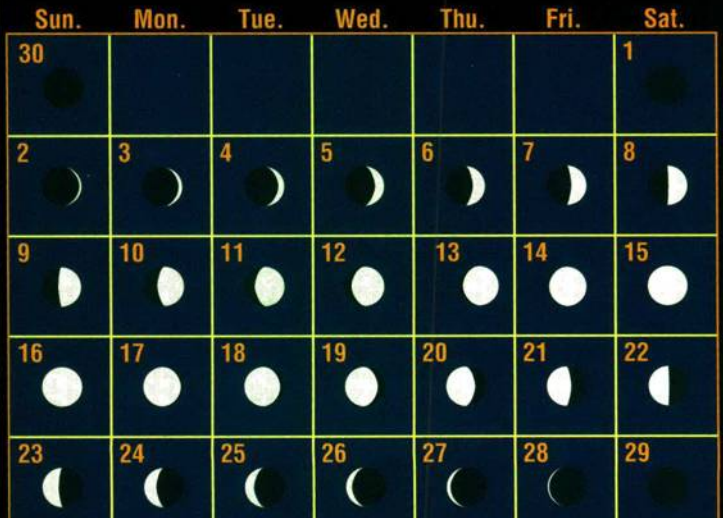
21 The Moon passes 5° north of Neptune, 2 p.m. EDT
Last Quarter Moon is at 11:18 p.m. EDT
The Moon passes 6° north of Uranus, midnight EDT

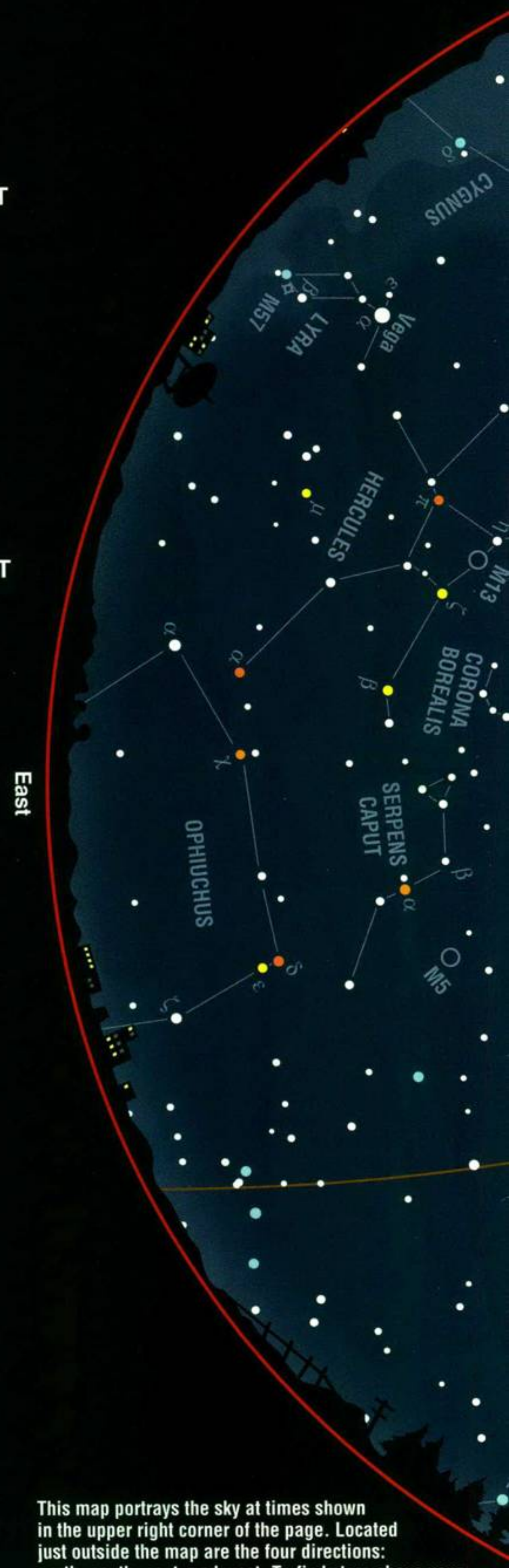
22 Lyrid meteor shower peaks

25 The Moon passes 6° north of Saturn, 9 p.m. EDT

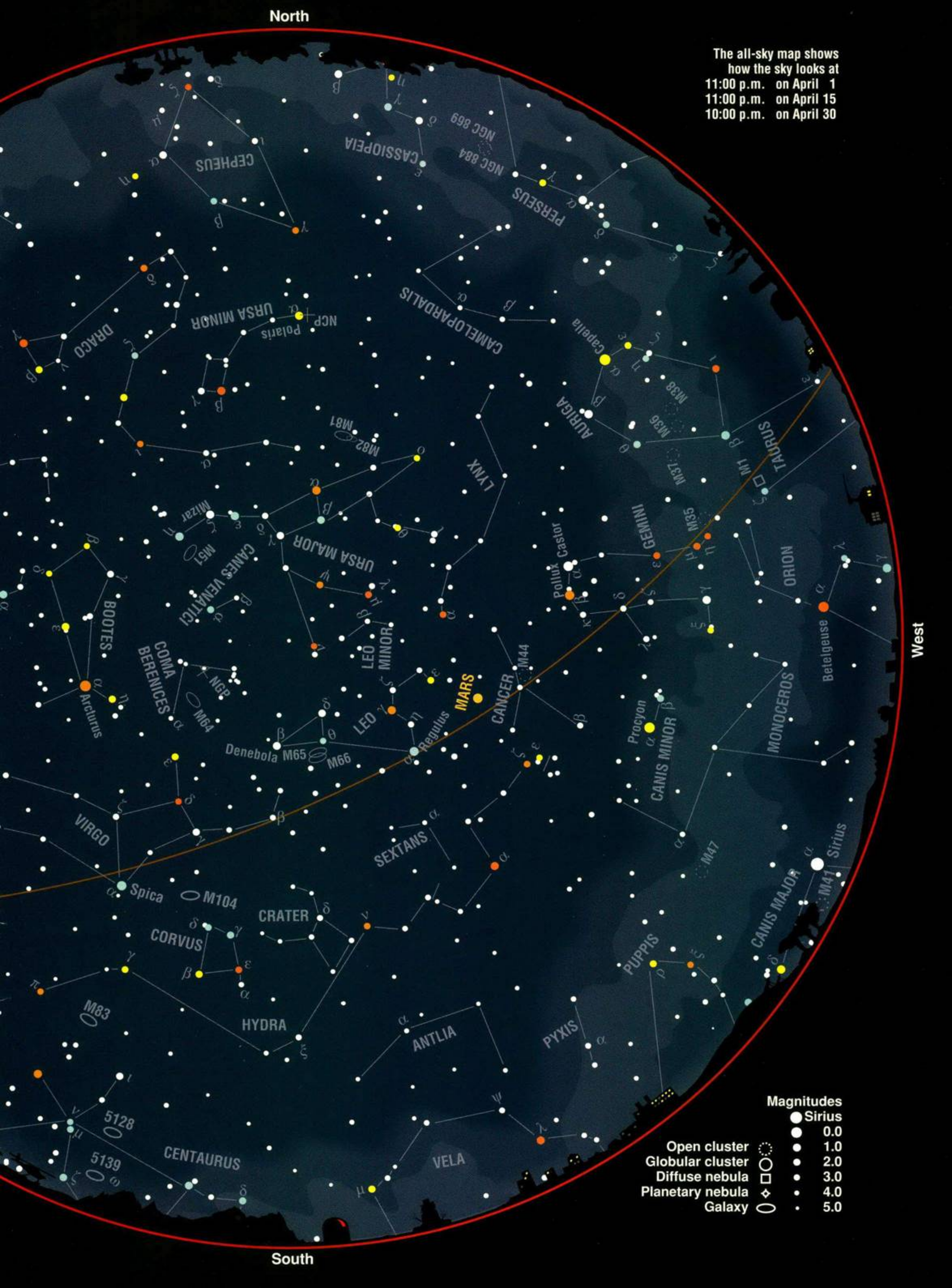
27 The Moon passes 4° north of Venus, 1 a.m. EDT
Neptune is stationary, 5 p.m. EDT

29 New Moon is at 1:36 p.m. EDT; annular solar eclipse (p. 58)





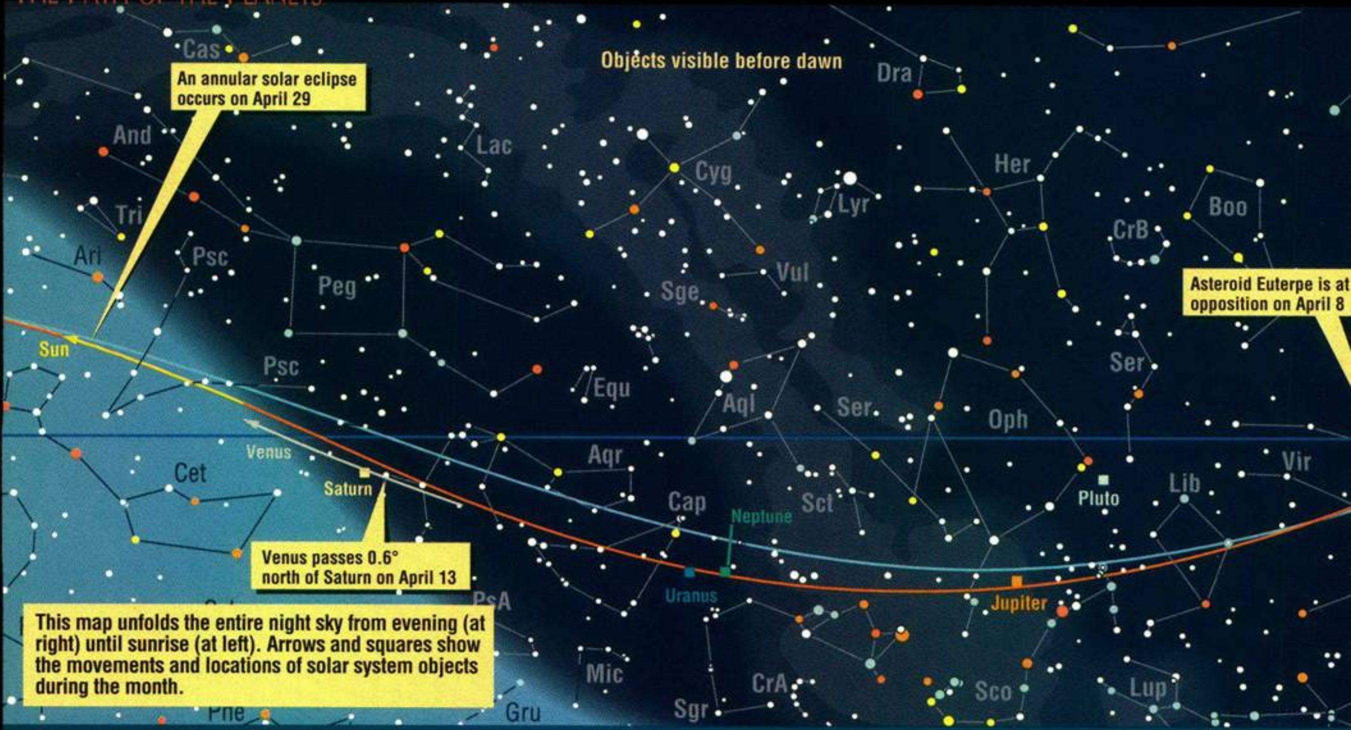
This map portrays the sky at times shown in the upper right corner of the page. Located just outside the map are the four directions: north, south, east, and west. To find stars above your horizon, hold the map overhead and orient it so a direction label matches the direction you're facing. The stars above the map's horizon now match what's in the sky.



The all-sky map shows how the sky looks at
11:00 p.m. on April 1
11:00 p.m. on April 15
10:00 p.m. on April 30

North
South
West
CEPHEUS
CASSIOPEIA
NGC 869
NGC 884
PERSEUS
DRACO
URSA MINOR
Polaris
NCP
CAMELOPARDALIS
Capella
AURIGA
M38
M36
M37
M1
TAURUS
M81
M82
LYNX
Mizar
M51
CANES VENATICI
URSA MAJOR
GEMINI
M35
Castor
Pollux
ORION
BOOTES
LEO MINOR
M44
Betelgeuse
COMA BERENICES
NGP
M64
Arcturus
MARS
CANCER
LEO
Regulus
Procyon
CANIS MINOR
MONOCEROS
Denebola
M65
M66
VIRGO
SEXTANS
M47
Sirius
M41
CANIS MAJOR
Spica
M104
CRATER
CORVUS
PUPPIS
M83
HYDRA
ANTLIA
PYXIS
5128
5139
CENTAURUS
VELA
Magnitudes
Sirius
0.0
1.0
2.0
3.0
4.0
5.0
Open cluster
Globular cluster
Diffuse nebula
Planetary nebula
Galaxy

THE PATH OF THE PLANETS

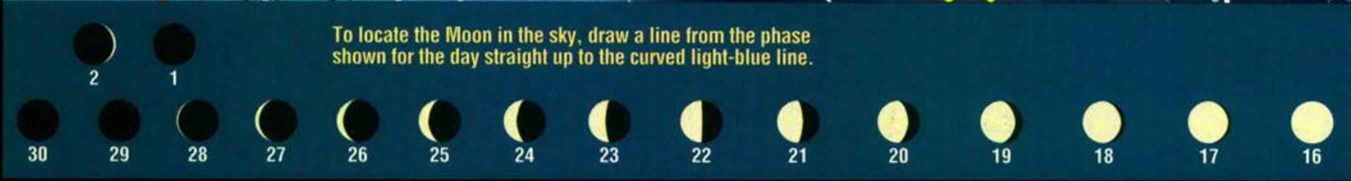

Objects visible before dawn
Cas
And
Tri
Ari
Psc
Lac
Peg
Cyg
Lyr
Dra
Her
CrB
Boo
Sge
Vul
Psc
Equ
Aql
Ser
Oph
Ser
Sun
Venus
Saturn
Cet
Aqr
Cap
Neptune
Sct
Pluto
Lib
Vir
Uranus
Jupiter
PsA
Mic
CrA
Sco
Lup
Phe
Gru
Sgr

An annular solar eclipse occurs on April 29

Asteroid Euterpe is at opposition on April 8

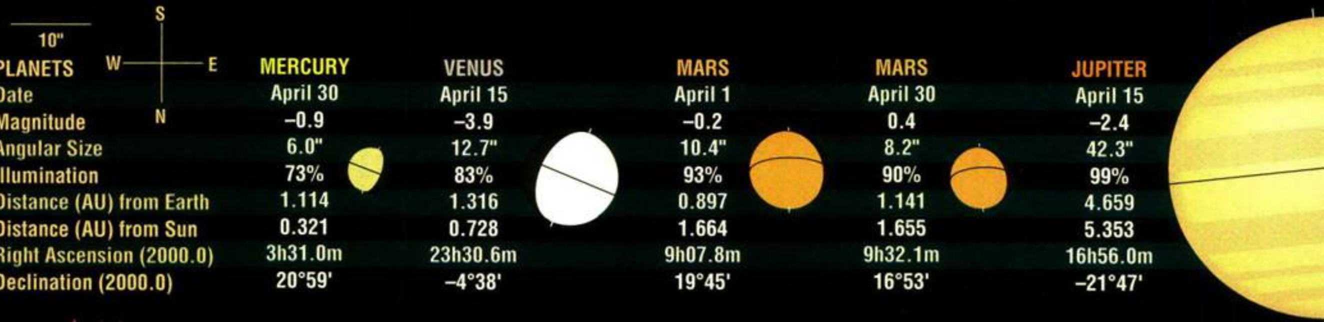
Venus passes 0.6° north of Saturn on April 13

This map unfolds the entire night sky from evening (at right) until sunrise (at left). Arrows and squares show the movements and locations of solar system objects during the month.


2
1
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16

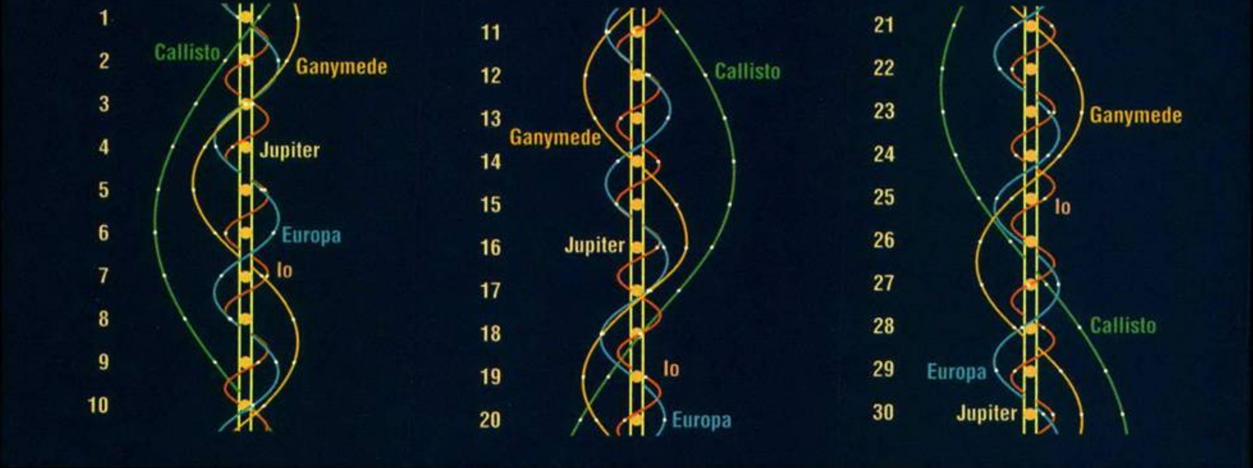
To locate the Moon in the sky, draw a line from the phase shown for the day straight up to the curved light-blue line.

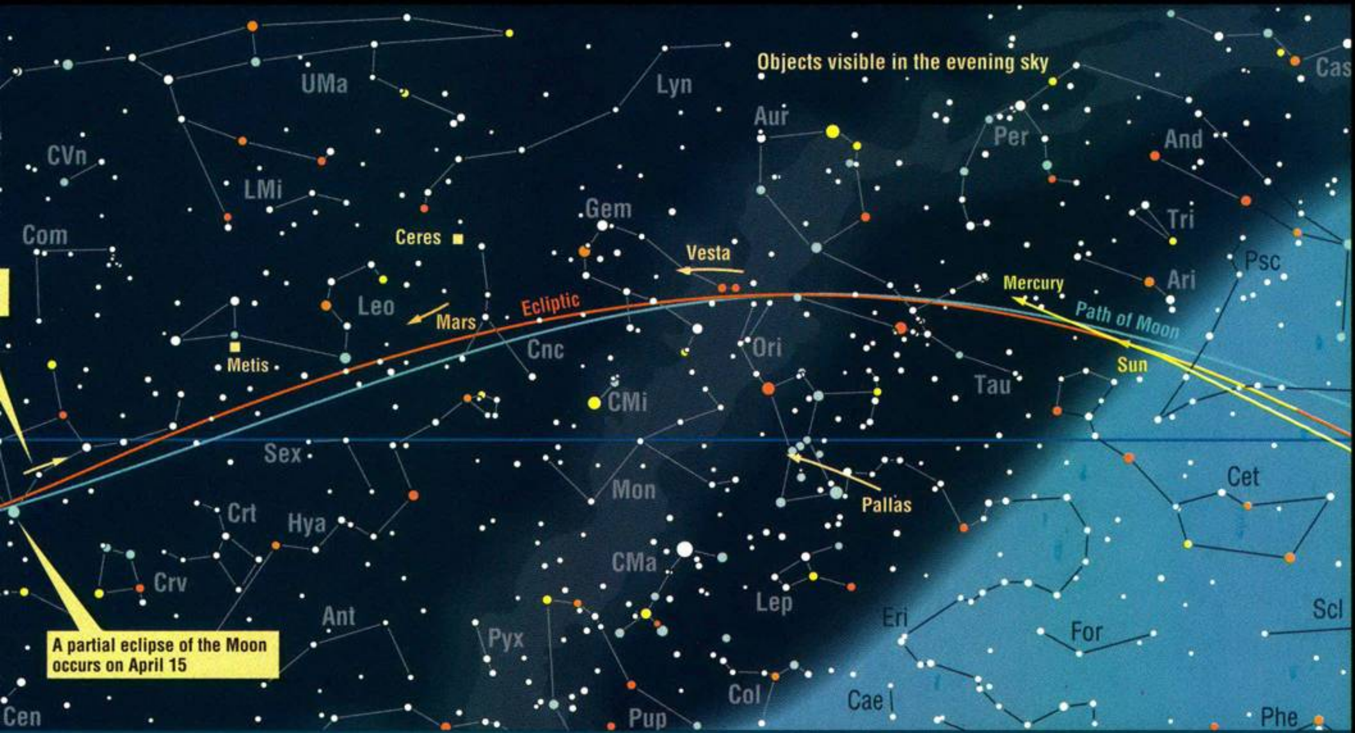
PLANETS	MERCURY	VENUS	MARS	MARS	JUPITER
Date	April 30	April 15	April 1	April 30	April 15
Magnitude	–0.9	–3.9	–0.2	0.4	–2.4
Angular Size	6.0"	12.7"	10.4"	8.2"	42.3"
Illumination	73%	83%	93%	90%	99%
Distance (AU) from Earth	1.114	1.316	0.897	1.141	4.659
Distance (AU) from Sun	0.321	0.728	1.664	1.655	5.353
Right Ascension (2000.0)	3h31.0m	23h30.6m	9h07.8m	9h32.1m	16h56.0m
Declination (2000.0)	20°59'	–4°38'	19°45'	16°53'	–21°47'



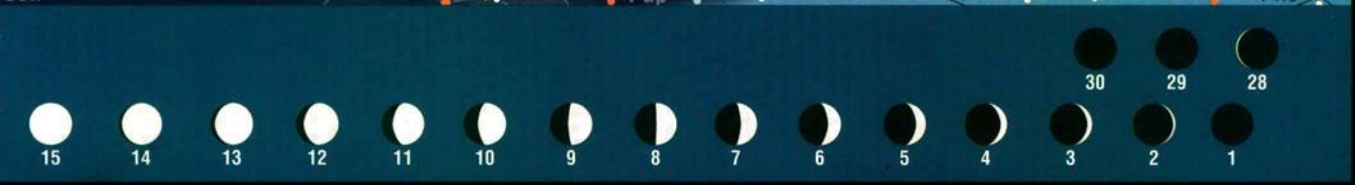
JUPITER'S MOONS

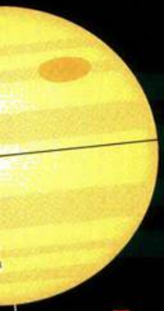
Dots display positions of Galilean satellites at 4 a.m. EDT on date shown. South is at top to match the view in a telescope.

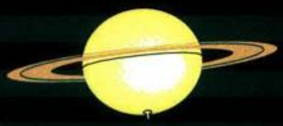


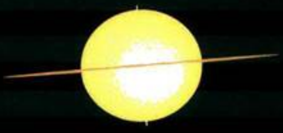

Objects visible in the evening sky
UMa
Lyn
Aur
Per
And
Cas
CVn
LMi
Com
Ceres
Gem
Vesta
Tri
Psc
Ari
Mercury
Leo
Mars
Ecliptic
Path of Moon
Metis
Cnc
Ori
Sun
Tau
CMi
Sex
Mon
Pallas
Cet
Crt
Hya
CMa
Crv
Lep
Ant
Eri
For
Scl
Pyx
Col
Cae
Phe
Cen
Pup

A partial eclipse of the Moon occurs on April 15


30
29
28
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1

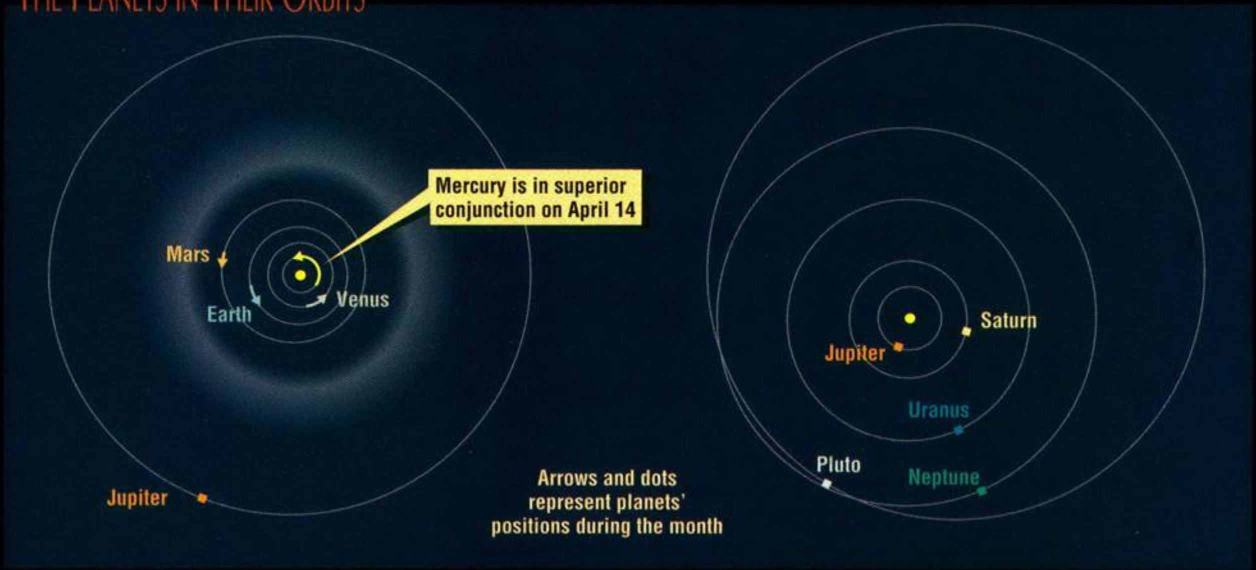






SATURN	SATURN	URANUS	NEPTUNE	PLUTO
April 1	April 30	April 15	April 15	April 15
1.2	1.3	5.8	7.9	13.7
15.7"	16.1"	3.5"	2.2"	0.1"
100%	100%	100%	100%	100%
10.570	10.294	19.782	30.171	29.032
9.656	9.648	19.707	30.171	29.831
23h19.5m	23h31.1m	20h10.7m	19h49.7m	16h03.8m
−6°19'	−5°09'	−20°35'	−20°29'	−6°35'

THE PLANETS IN THEIR ORBITS


Mars
Earth
Venus
Jupiter
Saturn
Jupiter
Uranus
Pluto
Neptune

Mercury is in superior conjunction on April 14

Arrows and dots represent planets' positions during the month hindquarters (15° is about the equivalent to the angular distance between the tips of your thumb and pinkie when you hold your outstretched hand at arm's length). The brightest star in this triangle is Denebola. About 15° northeast of it is a sprinkling of faint stars visible under a dark sky. This is the constellation Coma Berenices, or Berenices' Hair. This region marks the location of the north pole of the Milky Way Galaxy, one of two points around which the whole Galaxy spins.

When we look in this direction, we are looking perpendicular to the disk of the Galaxy. This region is obscured less than others by stars and dust in the Milky Way, giving us a much clearer view of the universe beyond. A small telescope reveals a vast collection of galaxies in Coma Berenices and in the western part of its southern neighbor, Virgo. The galaxies are islands of light consisting of untold billions of stars glimpsed across an ocean of space. This area is known as the Realm of the Galaxies, although that name is now less common as ever-more-powerful telescopes show that the entire sky, in all directions, is a realm of galaxies. Still, there's no substitute for an evening spent gazing with a backyard telescope toward the fuzzy star islands in Coma Berenices and Virgo (see "Explore the Virgo Cluster" on page 65 for more).

By the night of April 14/15, the Moon has waxed to Full. This isn't just any Full Moon, however: Not only does it undergo a partial eclipse visible to those in western North America and across the Pacific, it also passes in front of Virgo's brightest star, Spica, occulting it from view. (See boxes at right and on page 63.)

Meanwhile, where are the planets not visible in the evening sky? You can pretty much forget about **Mercury** the month. It reaches superior conjunction, lying behind the Sun as seen from Earth, on April 14 and won't be easy to see all month.

Taking a Bite Out of the Moon

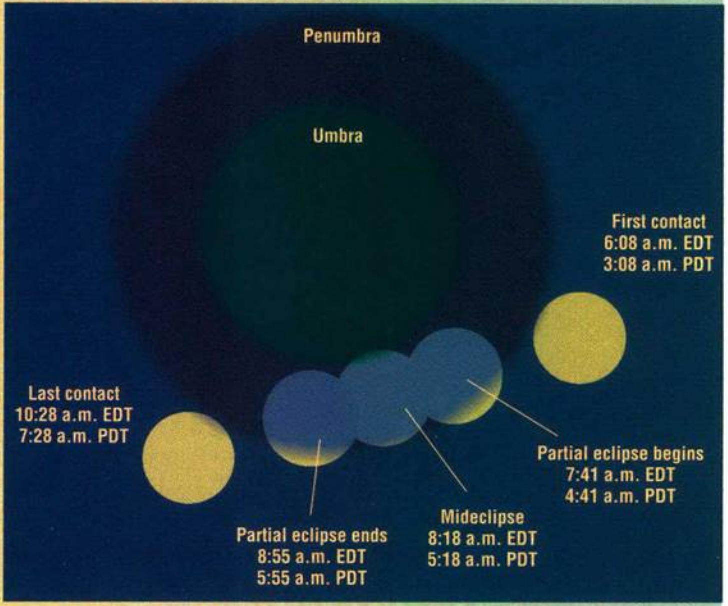
Darryl Mason

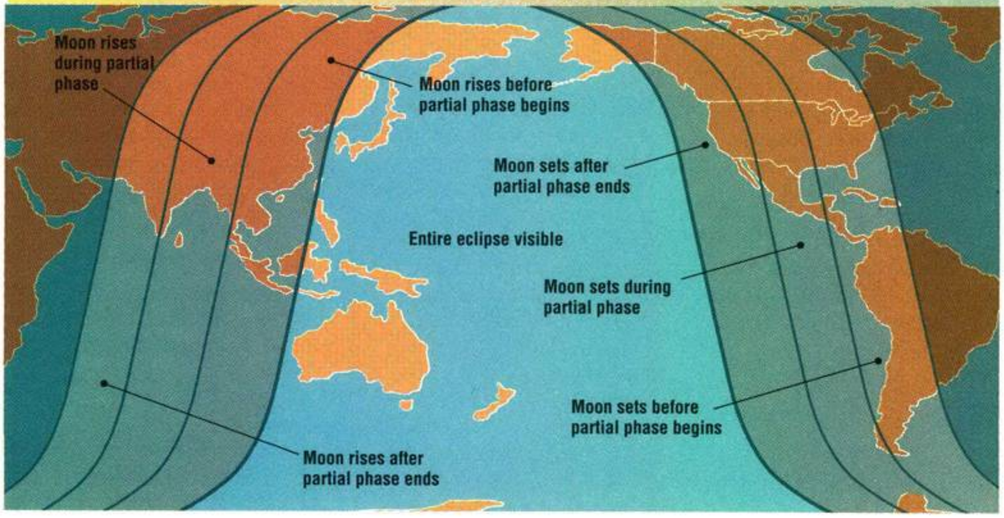
On the night of April 14/15, for the first time in nearly a year, the Moon passes through Earth's dark umbral shadow. Although only a small part of the Moon is in the shadow (12 percent at the peak), the eclipse is easy to see if you have a clear sky and the Moon is above the horizon.

Observers in Hawaii and across the Pacific to Australia and New Zealand will see all of the eclipse with the Moon high in the sky. Viewers in the western half of the United States and Canada and in most of Mexico will see at least part of the eclipse. The umbral phase begins at 7:41 a.m. EDT (4:41 a.m. PDT), meaning the Moon will lie near the western horizon across western North America. To see all of this phase, which concludes at 5:55 a.m. PDT, you need to live west of a line running through Arizona, Utah, Idaho, and British Columbia.

You can't beat a good pair of binoculars for an overall view of the eclipse. If they are bigger than 10x50s, however, you'll want to mount them on a tripod. For a close-up of the shadow's progress across the lunar surface, use your telescope and an eyepiece that yields 100x to 175x.

The major spectacle during most lunar eclipses is the Moon's color. But with only 12 percent of the Moon in Earth's shadow at this eclipse, the only "color" you're likely to see is gray. Count yourself among the eagle-eyed if you detect any hint of color. — *Rick Shaffer*


Penumbra
Umbra
First contact
6:08 a.m. EDT
3:08 a.m. PDT
Partial eclipse begins
7:41 a.m. EDT
4:41 a.m. PDT
Mideclipse
8:18 a.m. EDT
5:18 a.m. PDT
Partial eclipse ends
8:55 a.m. EDT
5:55 a.m. PDT
Last contact
10:28 a.m. EDT
7:28 a.m. PDT


Moon rises during partial phase
Moon rises before partial phase begins
Moon sets after partial phase ends
Entire eclipse visible
Moon sets during partial phase
Moon sets before partial phase begins
Moon rises after partial phase ends

The Starry Sky:
Virgo

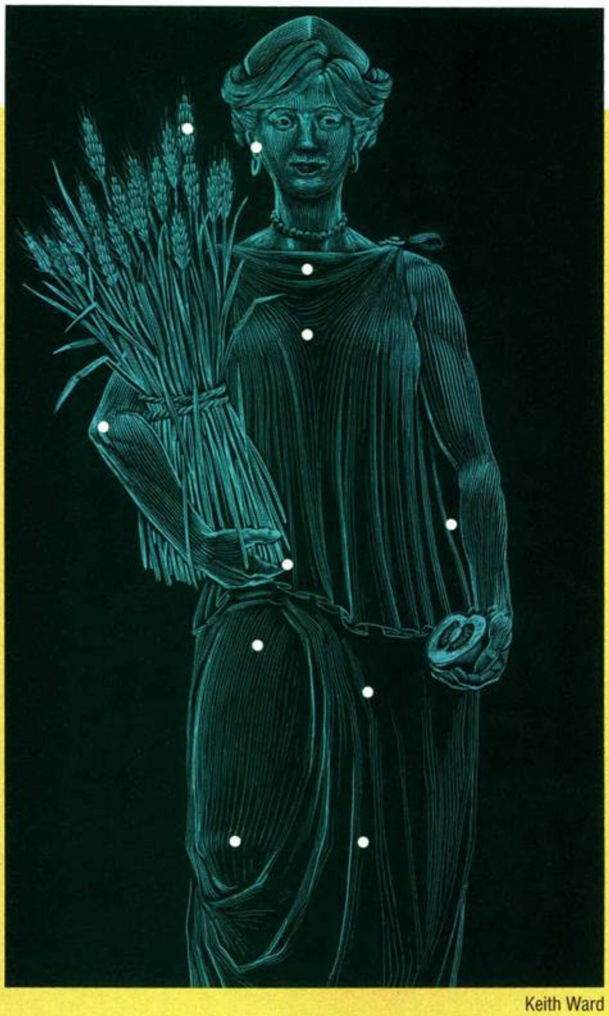
Last month we mentioned how to use the handle of the Big Dipper to find two prominent stars. Simply "follow the arc" in the Dipper's handle until you come to the bright star Arcturus, in the constellation Bootes, the Herdsman. Then "drive a spike" to Spica, in the constellation Virgo, the Maiden.

Spica, a sparkling blue-white star, shines at magnitude 1.0 from a distance of about 260 light-years. It is one of the most intriguing stars in the heavens, a spectroscopic binary star whose duplicity was first detected a little over a century ago. The two stars are separated by a mere 11 million miles from center to center, so they whirl around each other in just four days.

The name Spica means "ear of wheat." On old star maps, Virgo is often pictured as holding the wheat in her hand. She has always been associated with Earth goddesses, symbols of power in ancient cultures that were wholly dependent on agriculture for their survival. She is sometimes portrayed as scattering grains of wheat onto the Earth. The ancient Egyptians believed that the grains of wheat cast by the maiden were transformed into the myriad stars in the band of the Milky Way.

Our best-known legend about this constellation stems from Greek mythology. Demeter was the Greek goddess of agriculture, fertility, and marriage, and Persephone was her beautiful daughter. One day Hades, god of the underworld, caught sight of Persephone wandering in the fields, and kidnapped her. The Earth split for his black chariot as he carried her into the underworld to be his wife. Demeter was so stricken by the loss of her daughter that she neglected her duties. Crops failed, and people began to die of hunger. Finally Zeus, the king of the gods, worked out a compromise. Persephone would spend half of each year with her mother and half with her husband. Now when Persephone is in the underworld, the world endures the cold of winter. When Persephone returns to Demeter, spring arrives.

Spica is the only bright star in Virgo, which is the second-largest constellation after Hydra (see last month's Starry Sky). The rest of this constellation is fairly unimpressive, with no stars brighter than 3rd magnitude. If you have a small telescope, be sure to turn it on the star Gamma (γ) Virginis, also known as Porrima. It is an almost perfectly matched double star, whose components are yellowish in color and less than 3" apart.



Keith Ward

Although Virgo is faint and sprawling, she is true to the legends about her. This constellation conceals within her boundaries one of the most fruitful regions of the sky. The northwestern border of Virgo, spilling over into neighboring Coma Berenices, is a place where you will find many galaxies located far beyond the boundaries of our Milky Way Galaxy. Each fuzzy dot of light is an island holding billions of stars. One cannot help but wonder what beings may reside on planets orbiting those distant suns and what cultures may have evolved. And do they stand outside on their worlds, gazing at us? — *Deborah Byrd*

However, next month it puts in its best evening appearance of the year for Northern Hemisphere observers.

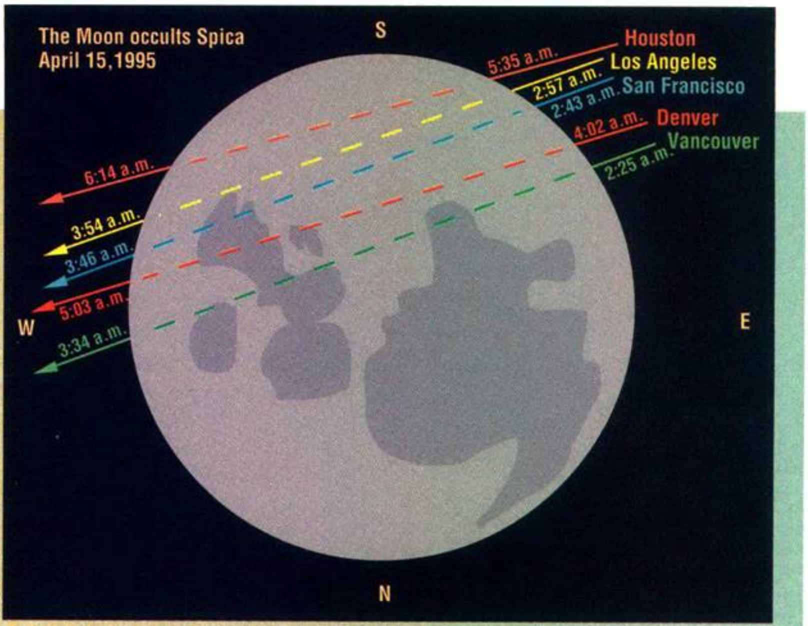
One planet rises invisibly during the midevening hours of April. **Pluto** will reach opposition next month, when Earth passes between it and the Sun. As a result, this month it rises in the east ever closer to the time of sunset, coming up only an hour after the Sun sets by the end of April. You'll need at least an 8-inch telescope to spot Pluto as a point of light moving slowly through the stars of far western Ophiuchus.

Jupiter rises shortly before midnight when April begins and a couple of hours earlier late in the month. It also resides in Ophiuchus, but well to the southeast of Pluto and near the figure of Scorpius, the Scorpion. It lies just 8° northeast of 1st-magnitude Antares, Scorpius' brightest star. Shining boldly white at magnitude –2.4, however, it nearly overwhelms Antares. On April 17, the waning gibbous Moon forms a triangle with Jupiter and Antares. The following evening, the trio forms a line.

Through a telescope, Jupiter's disk appears 42" in equatorial diameter and slightly less from pole to pole. As the largest planet in our solar system, Jupiter always looks big and displays lots of detail in a telescope. Details in the planet's dark belts and brighter zones change constantly. One way to track these changes is to take a sheet of white paper and draw the oval shape of Jupiter, including its belts and zones. (A 70° ellipse template, available in art supply shops, will give you the exact shape of Jupiter.) Then add fine detail during each night's observing session.

Earth is now gaining on this planet as the two orbit the Sun. A sure sign of Jupiter's upcoming opposition, when Earth passes between it and the Sun, occurs on April 1.

The Full Moon Occults Spica

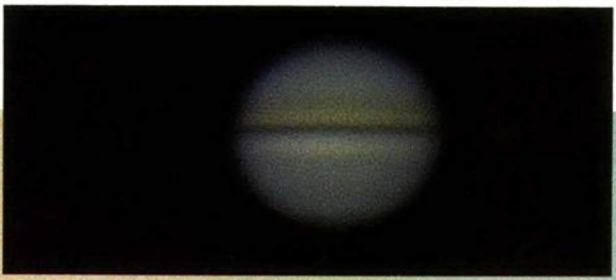


The Moon has a busy night on April 14/15. Not only does it pass through Earth's shadow (see page 61), it also passes in front of the 1st-magnitude star Spica. Observers in most of North America will see the Moon block the light of the star for about an hour, beginning some one to two hours before the eclipse takes place.

This won't be an easy occultation to observe, however. The Moon is Full that night (as it must be to be in eclipse), so to spot the star you have to contend with lots of glare. Fortunately, Spica is bright enough that you should be able to watch it disappear and reappear anyway.

Spica disappears behind the dark limb of the Moon, which is just a couple hours from being Full. That, along with the fact that you can see the Moon approaching the star, will make the disappearance easier to see. Try to find Spica at least 30 minutes before the occultation begins (use the diagram above to approximate the time for your location). Binoculars will let you see the star as it approaches the Moon's limb, but you'll want the stable platform and higher magnification a telescope provides to actually witness the star's disappearance. — *Rick Shaffer*

Observer's Challenge:
Saturn's Moons in Eclipse



Charles Capen

If you've been observing Saturn in a telescope for the past few years, you no doubt have noticed its rings getting closer to edge-on. Approximately every 15 years, the plane of the rings tilts edge-on to our line of sight, and because the rings are so thin, they disappear from view.

Saturn's satellites orbit the planet in nearly the same plane as the rings, so those orbits now also are tilted nearly edge-on. When this happens, the satellites sometimes pass in front of (occult) or eclipse one another. As Saturn returns to the morning sky this month, observers will have up to five of these mutual satellite events to watch.

The observations will be tricky because the Sun rises shortly after Saturn, meaning each event is visible only from a limited area. The two events with the largest magnitude drops, thus making them the easiest to see in the eyepiece, occur on April 22. In the first, Tethys passes in front of Dione, dropping the combined light of the pair by 47 percent. This occurs around 5h45m universal time (UT), so western Africa and Portugal get the best view.

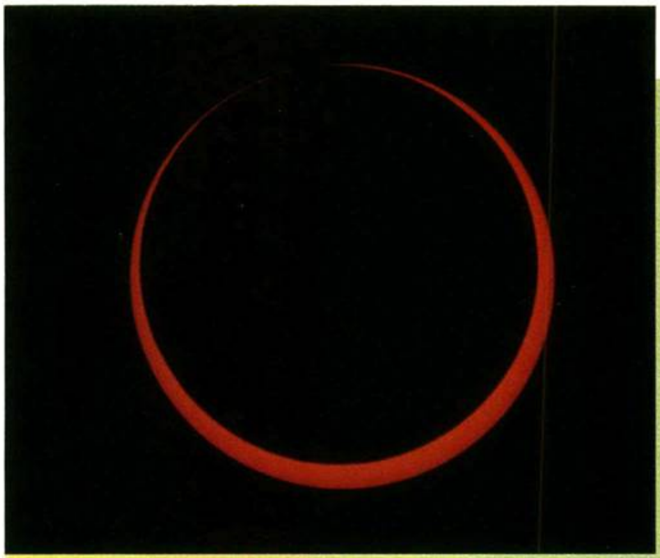
The second event occurs around 16h38m UT, when Enceladus eclipses Mimas, and the light drops 37 percent. This event is best seen from New Zealand and points east. The number of mutual events picks up dramatically over the coming months, so almost everyone will have several events to view each month. — *Rick Shaffer*

EVENTS OF THE SATURNIAN SATELLITES

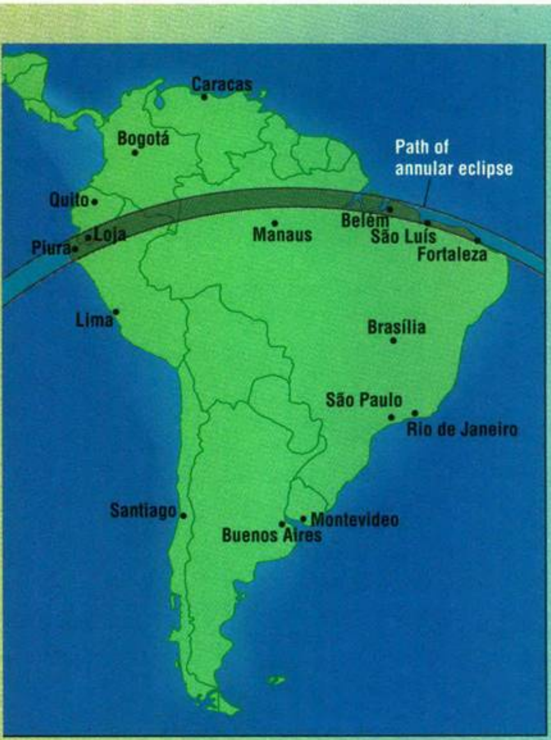
Date	Begin Time	End Time	Event	Type of Event	Light Loss	Distance
April 17	16h24.9m	16h26.9m	Enceladus occults Tethys	Partial	12%	3.8
April 22	5h43.8m	5h48.6m	Tethys occults Dione	Annular	47%	4.9
April 22	16h36.9m	16h41.6m	Enceladus eclipses Mimas	Partial	37%	2.4
April 27	23h05.2m	23h08.5m	Tethys occults Rhea	Partial	13%	4.7
April 30	1h55.7m	1h57.0m	Tethys occults Mimas	Total	12%	2.3

Begin Time: Universal time at start of event. (Subtract 4 hours to convert to EDT.) **End Time:** Universal time at end of event. **Event:** The nature of the event and the moons involved. **Light Loss:** For eclipses — the percent of light lost by the eclipsed satellite at midevent; For occultations — the percent of light lost from the combined light of both satellites at midevent. **Distance:** The distance of the satellite from Saturn's center expressed in units of Saturn's equatorial radius.

A South American Solar Eclipse



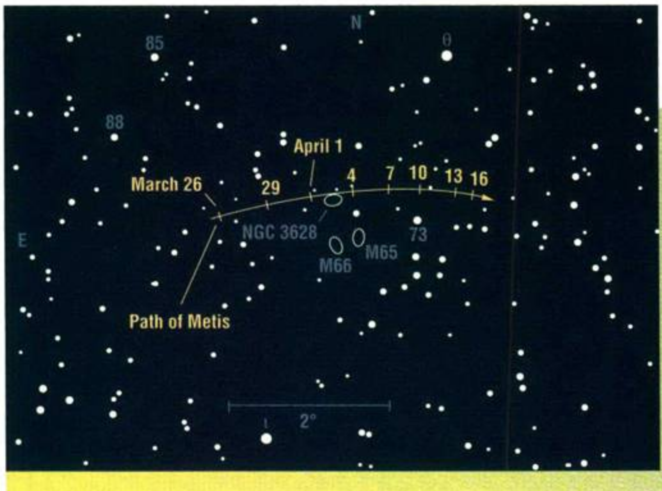
Mark R. Logan



The longest solar eclipse remaining in the 20th century arrives on April 29, when the Moon lies in front of the Sun for up to 6 minutes 37 seconds. This is an annular eclipse, meaning that the Moon appears slightly smaller than the Sun, so a thin ring, or annulus, of sunlight remains visible around the Moon. The bad news is that annularity occurs over mostly inaccessible regions of northern South America.

Maximum eclipse occurs in western South America, about 100 miles northeast of Piura, Peru. There the Moon will cover 95 percent of the Sun's diameter. After crossing northern Peru and southern Colombia, the track heads eastward into the Amazon River basin. The only big cities in the path of annularity are Belém and Fortaleza, both located along the northeast coast of Brazil, where the eclipse occurs as sunset approaches. — *Rick Shaffer*

Metis Passes Through the Leo Trio



Asteroid 9 Metis puts on a good show during the first part of April. Though not particularly bright (it glows around 10th magnitude), this 90-mile-wide minor planet passes near three bright galaxies in the tail of Leo, the Lion.

The Leo Trio lies just 2.5° southeast of Theta (θ) Leonis. One of the easiest ways to locate the trio is to position the field halfway between Theta and Iota (ι) Leonis. An eyepiece yielding a 1° field of view shows all three galaxies at once. M65 and M66 are the brightest, each glowing at 9th magnitude and showing bright nuclei and milky glowing disks. Slightly fainter than these two is the edge-on spiral NGC 3628, which lies just north of the others.

In early April, Metis comes barreling through the Leo Trio, passing just north of NGC 3628 on April 2 and 3. You should be able to recognize Metis by comparing your eyepiece view with the finder chart at left (positions are shown for 11 p.m. EDT, 10 p.m. CDT, 9 p.m. MDT, and 8 p.m. PDT). If not, return to the area a night or two later and look for the "star" that has moved. That will be Metis. — *Rick Shaffer*

COORDINATES FOR METIS

Date	R.A. (2000)	Dec.
March 26	11h26.3m	13°23'
March 29	11h23.8m	13°31'
April 1	11h21.5m	13°37'
April 4	11h19.3m	13°41'
April 7	11h17.4m	13°43'
April 10	11h15.7m	13°43'
April 13	11h14.3m	13°42'
April 16	11h13.1m	13°38'

First Views:
Explore the Virgo Cluster

Nowhere in the sky will you be able to explore more galaxies than in Virgo and its northern neighbor, Coma Berenices. Two hundred years ago, Charles Messier catalogued thirteen in an 8° by 5° area, but photographs show thousands, a few hundred of which can be seen in a small scope on a dark, moonless night.

Most of the galaxies you see here belong to the Virgo Cluster, the nearest large grouping of galaxies to Earth at a distance of roughly 50 million light-years. Astronomers recently observed Cepheid variables in both M100 and NGC 4571, helping narrow estimates of the distance scale of the universe (see "How Far to Virgo?" March 1995).

A good place to start a tour of the cluster is at its center, about 4° northwest of 5th-magnitude Rho (ρ) Virginis. There you will find the mammoth elliptical galaxy M87. Glowing at magnitude 8.6, this galaxy can be glimpsed even in binoculars. In a small scope, you'll see a fuzzy ball of light with little detail. With nearly a trillion stars, M87 ranks as one of the biggest galaxies known.

Just 1° northwest of M87 lie two other bright ellipticals: M84 and M86. At magnitude 9.2, M86 is a bit brighter than M84 and appears slightly oval, while M84 is somewhat smaller and appears circular.

But the Virgo Cluster consists of more than just ellipticals. Two bright spirals lie near 6 Comae Berenices, a 5th-magnitude star 3° northwest of M84. The 9.8-magnitude spiral M99 appears nearly face on, allowing you to see the spiral arms winding out from a bright central glow.

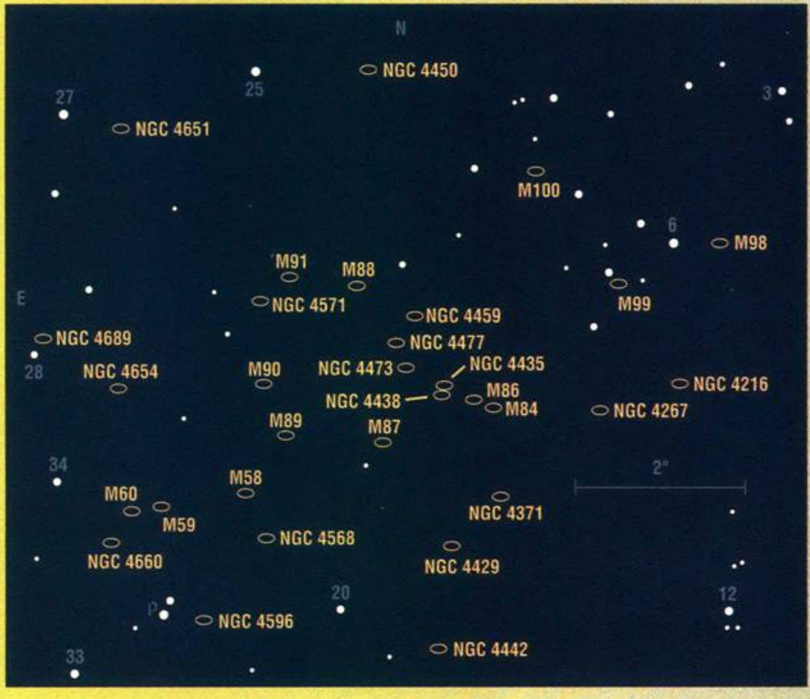
A little over 1° northeast of M99 lies the 9.4-magnitude spiral M100. Any scope shows the galaxy's bright center, though you'll need an 8-incher to see the subtle spiral arms. It was in these arms that astronomers found Cepheids, making M100 an inviting target for observers. But don't overlook the other beautiful galaxies that make this area the sky's best hunting ground for galaxies. — *Rick Shaffer*

Kim Zussman

David Healy

Kim Zussman

Dale E. Mais



On that day Jupiter appears stationary in front of the stars; afterward, it begins slow retrograde (westward) motion. Jupiter will grow brighter in our sky and appear larger through the eyepiece as it approaches its June 1 opposition.

Shortly after midnight, two more planets ascend over the eastern horizon. **Uranus** lies in Capricornus, where it shines at magnitude 5.8 and displays a 3.5"-diameter disk. **Neptune**, in Sagittarius, glows at magnitude 7.9 and sports a 2.2"-diameter disk.

The night's finale takes place within the hour before dawn. As April begins, you can see **Venus**, a magnificent rival to the brightest earthly streetlights, hanging just above the eastern horizon. It then shines at magnitude –4.0. After about a week, you will see another bright object just below Venus. This is **Saturn**, now emerging from the dawn after traveling behind the Sun. Saturn shines at magnitude 1.2 among the background stars of Aquarius. On April 13, Venus passes just 0.6° north of Saturn. The extremely bright planet and much fainter one are a lovely sight in the gathering dawn. Also be sure to watch around April 25, 26, and 27, when the waning crescent Moon sweeps past the planetary duo.

Telescopically, Venus appears as a rather uninteresting gibbous disk measuring 13" in diameter. Saturn, known for its glorious rings, appears less than glorious this month. Twice in every 30-year orbit of Saturn, Earth passes through the plane of the planet's rings. With the next ring passage coming up in May, Saturn's rings now appear nearly edge-on to us and, as a result, are barely visible. If you want to follow the changing aspect of the planet's rings over the next several months, you should start scrutinizing it now. □

Deborah Byrd writes and produces the daily "Earth and Sky" radio series. Rick Shaffer is an engineer and writer who lives in Arizona.

READER REPORTS SPECIAL

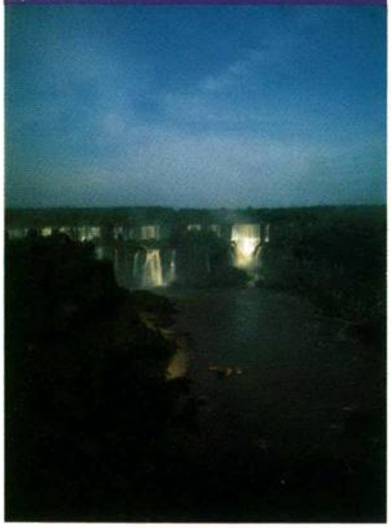
Descent Into Darkness

November's solar eclipse delighted backyard astronomers across half a dozen South American countries.

by David J. Eicher

They saw it in Brazil. They saw it in Chile. They saw it in Paraguay, Bolivia, Peru, and Argentina. Everywhere in the path of totality, fair weather prevailed and darkness fell over the land. On the morning of November 3, 1994, viewers stood and watched in awe or madly snapped away with their cameras at the total eclipse of the Sun, which lasted as long as four minutes. Thousands had assembled outdoors or traveled from the United States, Canada, Europe, and Japan to bask in the special darkness. Here are some reports from Brazil, Bolivia, and Chile.

Iguaçu Falls, Brazil, an Eclipse Tour Highlight
by Hal Jandorf

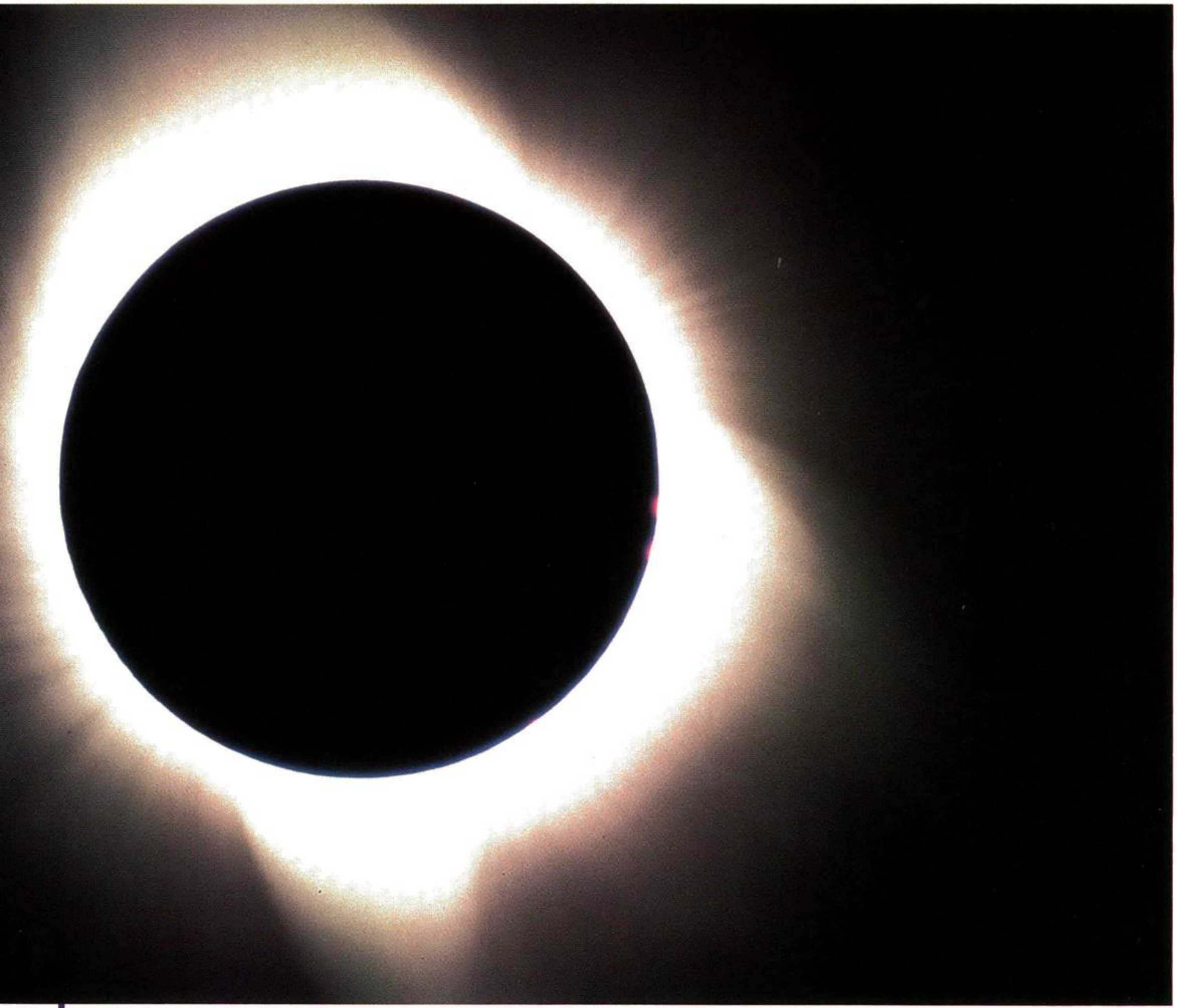


"Totality was very emotional," said Nelson Falsarella, Mars Recorder for the Rede de Astronomia Observacional in São José do Rio Preto, Brazil, who watched the eclipse from Chapecó, Brazil, near the centerline. "I was trembling and crying; It was the best experience of my life." From the airstrip at Corcórdia, in southern Brazil, Gilberto Klar Renner reported seeing shadow bands on the runway just before totality began. Shadow bands are mottled patches of light and dark caused by refraction in Earth's atmosphere seen just before and after totality. Renner also says that "mosquitoes attacked people during totality just as if it were night."

Among those who traveled to South America was Wisconsinite Dan Koehler, who watched the event with a group near Sevaruyo, Bolivia. "This was by far the darkest eclipse I have ever seen," says Koehler. "It produced the most beautiful corona, with one white streamer extending outward by $3^{1}/_{2}$ solar radii. A spectacular hooked prominence could be seen on the Sun's limb, as well."

Brian P. Calen of Dobbs Ferry, New York, traveled with Peter Williams and Richard Ward to see the eclipse from Sevaruyo. "We awakened at sunrise on eclipse morning to see high, patchy clouds," says Calen. "By first contact the clouds were dissipating, and when totality began we were in fine shape. I was particularly struck by the bright presence of Venus and Jupiter during the total phase."

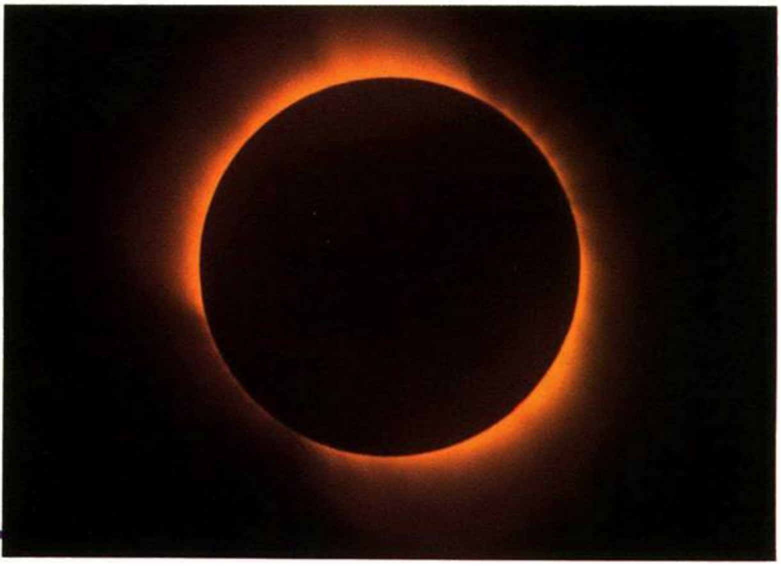
David and Glenna Harrington of Troy, Michigan, watched in awe, also near Sevaruyo. "The eclipse was a spectacular sight," they say. "At our altitude of 12,000 feet the planets were silhou-

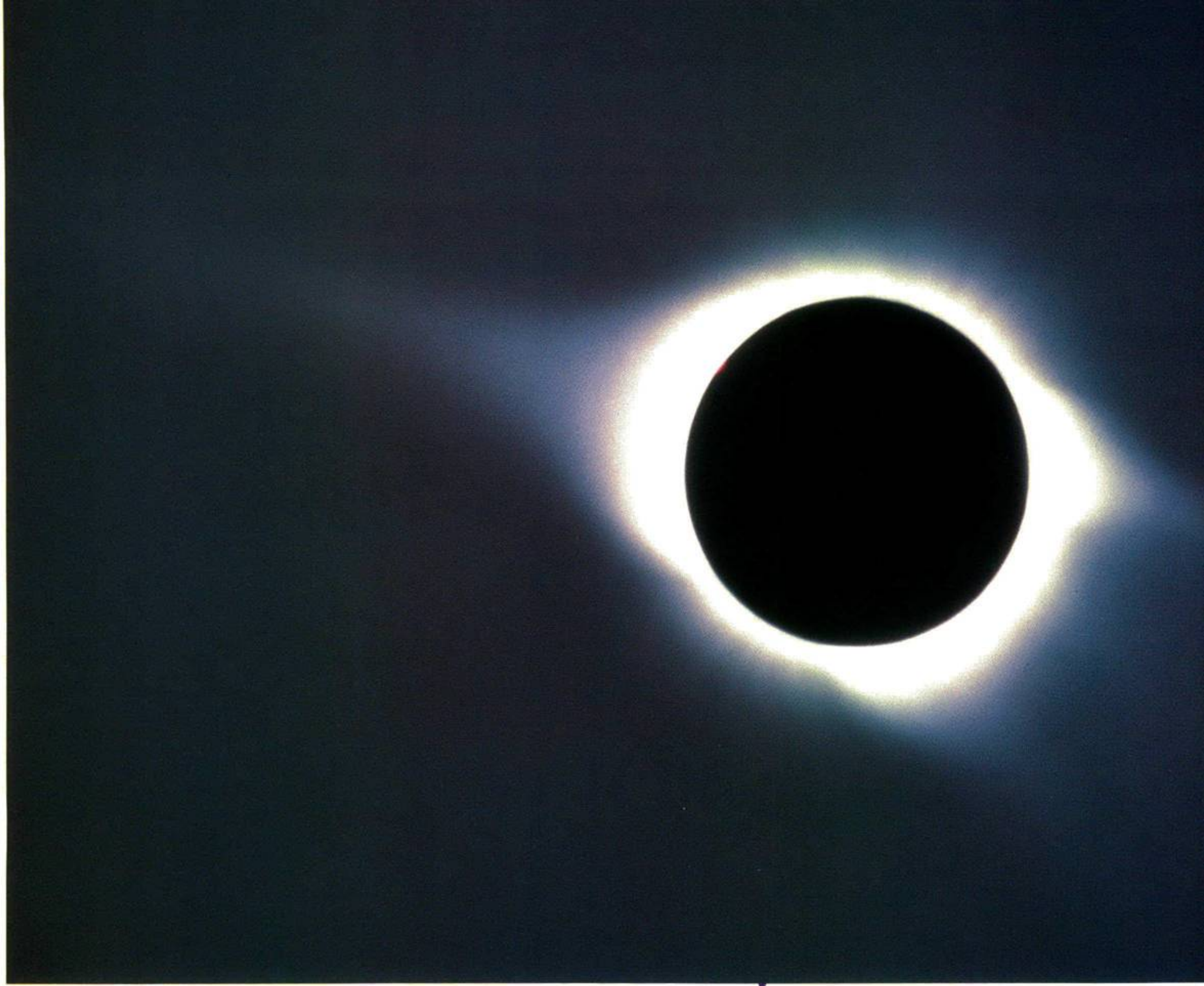


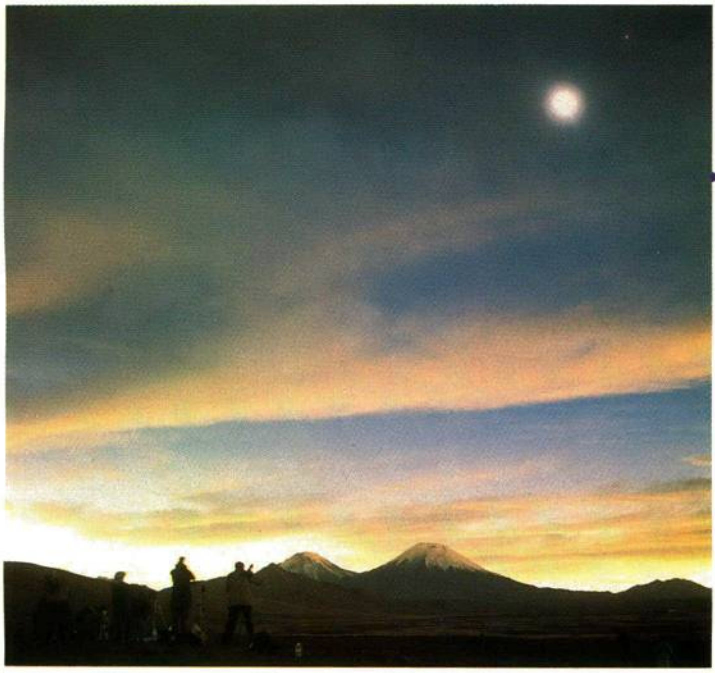
November 3's Brilliant, Velvety White Corona
by Hal Jandorf
(94mm f/7 refractor, Fuji Provia 100 film, 1/2-second exposure, taken in Iguaçu Falls, Brazil)

Darkness Blankets the Sky
by Nelson B. Arnstein
(7.5mm lens at f/5.6, Kodak Gold 200 film, 1/4-second exposure taken in Neuland, Paraguay)

Yellowish Polar Brushes Mark the Inner Corona
by A. W. Steinbrecher
(70mm refractor at f/13, Fuji Provia film, taken in northern Chile)







A Ribbon of Deep, Outer Corona
by Ernie Piini
(80mm f/8 refractor, Fuji Provia film, 2-second exposure taken in Sevaruyo, Bolivia)

Eclipsed Sun and Venus Over Chilean Volcanos
by Michael Maunder
(65mm lens at f/5.6, Fuji Velvia 50 film, 3-second exposure taken in Parinacota, Chile)

Prominence Adorns the Sun's Limb
by Paul Moeller
(5.6-inch f/7 refractor, Fuji Reala 100 film, 1/1000-second exposure taken near Arica, Chile)

Brazilian Amateurs Watch the Eclipse Progress
by Nelson Falsarella
(taken in Chapecó, Brazil)

etted against a black sky. The diamond rings at second and third contact lasted a long time, and we saw the shadow cone approaching from the west across the Bolivian altiplano and receding to the east."

Situated at Lauca National Park near Putre, Chile, were Alan Dyer and a team of nervous eclipse chasers from the Royal Astronomical Society of Canada, Calgary Centre. The extreme altitude of the site, the chilly air, and the lack of sleep for most members tested their stamina. In the distance rose the symmetrical cones of the Parinacota volcanos, the 20,000-foot mountains that symbolize the park. The group hoped for a clear sky but as eclipse time approached, persistent high cirrus drifted above their heads all morning. Would the Sun be in the clear at eclipse time? Would it shine through clouds, visible only during quick peeks?

Dyer and company debated chasing down the only highway in the area at the last minute to find clearer skies. They stayed put, however, and hoped for a clear patch. "From our vantage point, we clearly saw a dark shadow approaching us from the west shortly before totality," says Dyer. "As it reached us, the rapid descent into darkness was fantastic. A prolonged diamond ring finally gave way to totality. The corona exploded into view.

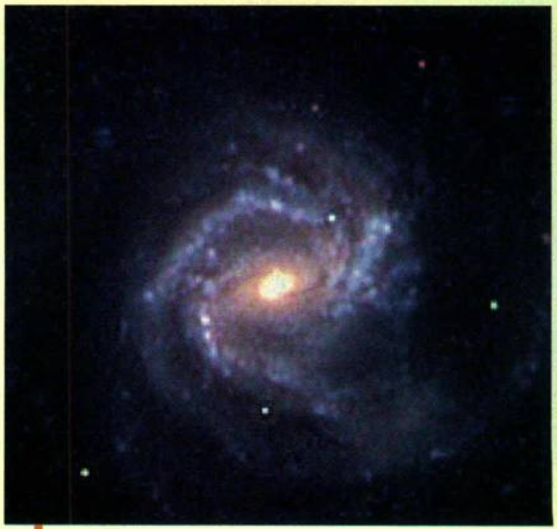
"It's amazing how people experience eclipses," says Dyer. "No one person can take in the whole scene, remember it all." In the end, every person who went captured their own eclipse memories and carried them home safe and secure, to be reopened vividly many times before the dark shadows of the next eclipse approach. □

Bolivian Soldiers Enjoy the Eclipse
by Deborah K. Smith

Twelve Splendid Spirals

Bright nuclei, knotty arms, mottled patches of light — a 6-inch or larger scope pulls them all into view.

by Alan Goldstein



M61 in Virgo
Mag. 9.7, Size 6.0' by 5.5'
25-inch f/5 reflector, ST-6 CCD camera

by Jack Newton

Springtime is galaxy time. As the ground thaws and the Milky Way rolls out of sight to uncover an evening sky filled with faraway galaxies, it's time to unpack your scope and rediscover the wonders of the deep sky.

Twelve spiral galaxies offer a variety of shapes and brightnesses you can see with your scope easily from a reasonably dark site. A 6-inch or 8-inch scope can give satisfying views, and dramatic details appear in scopes 10 or 12 inches in diameter. These galaxies give you the opportunity to develop your perception as a deep-sky observer because they present glowing spiral arms, bright nuclei, knots of faint light, and mottled patches, and are often set in pretty starfields. The challenge is to see such features, pushing your observational abilities to the limit.

The galaxies will help you to observe carefully because in some cases they reveal subtle differences in details. The key to viewing them is to set up your scope away from local lights on a dark, transparent, moonless night. Allow 45 minutes to an hour under the stars for dark adaptation before doing any serious observing. This allows your eyes to maximize their sensitivity to faint light.

What follows is my guided tour through what you'll see, beginning with the evening sky and moving eastward through the midnight and early morning hours. The tour will carry us through the obscure southern constellation Antlia, to the bright group of galaxies in Canes Venatici, through the thick cloud of the Virgo Cluster of galaxies, into Hydra, and then way around the sky to Cepheus. Finally, we'll consider three magnificent galaxies in Pisces and Triangulum that peek above the horizon just around dawn this month but will give you targets to continue plying your skills on as the summer waxes. To find these galaxies, consult a basic star atlas like *Philips' Color Star Atlas* by John Cox and Richard Monkhouse or Wil Tirion's *Sky Atlas 2000.0*.

To begin, find an observing site with an unobscured southern horizon. First you'll want to locate the triangular constellation Antlia, which resides south of long and winding Hydra, whose brightest star, Alphard, easily rises over the treetops. Our first target may be found $3\frac{1}{2}$° south of the 5th-magnitude double star Theta (θ) Antliae. The low surface brightness galaxy **NGC 2997** (mag. 10.6_B, size 8.1' by 6.5') has a bright center and hazy spiral arms oriented nearly face-on. (The subscript B means the galaxy's brightness was measured in

M33 in Triangulum
Mag. 5.7, Size 62' by 39'
12.5-inch f/7 reflector, Fuji Super HG 400 film, composite of two 45-minute exposures

by Tony and Daphne Hallas

NGC 2997 in Antlia
Mag. 10.6_B, Size 8.1' by 6.5'
18-inch f/4.5 reflector, hypersensitized Tech Pan film, 30-minute exposure

by Dave Young

blue light rather than visual light, so as you see it in the eyepiece it's somewhat brighter than 10th-magnitude.)

Once you've enjoyed viewing this southern beauty, orient your scope far to the north in the constellation Canes Venatici, south of the handle of the Big Dipper. Three of the sky's most alluring galaxies reside in the area, the **Whirlpool Galaxy** (M51), **M101** (NGC 5457), and **M106** (NGC 4258). The Whirlpool (mag. 8.4, size 11.0' by 7.8'), 3½° southwest of 2nd-magnitude Eta (η) Ursae Majoris, the end star in the Dipper's handle, is visible as a hazy patch even in binoculars. A 6-inch scope reveals the face-on galaxy's pale spiral arms and bright, round center. On a dark night you'll easily see the little interloping galaxy NGC 5195, considered a part of the Whirlpool because it is attached to the larger galaxy by a bridge of luminous material. Large, face-on galaxy M101 (mag. 7.7, size 26.9' by 26.3'), 5½° northeast of Eta Ursae Majoris, is shaped like a glowing wheel as seen with small scopes, showing a bright center and patchy spiral arms set out like spokes over a large field of view. M106 (mag. 8.3, size 18.2' by 7.9'), found 6½° northwest of 4th-magnitude Beta (β) Canum Venaticorum, is a lovely spiral with an oval center, patchy regions of dark material near the nucleus, and a large oval fuzz containing two diffuse spiral arms.

As the evening hours slip away, continue the tour southward into the Virgo Cluster of galaxies, the nearest large group of galaxies outside our own. Here you will

NGC 925 in Triangulum
Mag. 10.0, Size 9.8' by 6.0'
25-inch f/5 reflector,
ST-6 CCD camera

by Jack Newton

M106 in Canes Venatici
Mag. 8.3, Size 18.2' by 7.9'
25-inch f/5 reflector,
ST-6 CCD camera

by Jack Newton

M74 in Pisces
Mag. 9.2, Size 10.2' by 9.5'
25-inch f/5 reflector,
ST-6 CCD camera

by Jack Newton

find the bright and easily observed spirals **M61** (NGC 4303), **M99** (NGC 4254), and **M100** (NGC 4321). M61 (mag. 9.7, size 6.0' by 5.5') lies 1° south-southwest of the 6th-magnitude double star 17 Virginis. The galaxy appears as a face-on spiral with kinky arms that are plainly visible at moderate powers in an 8-inch scope. The whole galaxy appears wrapped in a faint halo of light. M99 (mag. 9.8, size 5.4' by 4.8') resides 1° southeast of the 5th-magnitude star 6 Comae Berenices. It looks like a tight knot of light surrounded by a very faint diffuse glow, with spiral arms faintly visible in a 10-inch scope, particularly one arm stretching prominently away from the nucleus. M100 (mag. 9.4, size 6.9' by 6.2'), one of the galaxies used recently to accurately determine the distance to the Virgo Cluster, floats 2° northeast of M99. M100 has a very bright center and spiral arms that stand out more plainly than those of M99.

As late evening transforms into midnight, and you have decided to push on to all twelve galaxies, move southward to lonely Hydra to see **M83** (NGC 5236), a bright spiral with open arms located $3^1/_2$° northwest of 4th-magnitude 1 Centauri. M83 (mag. 8.2_B, size 11.2' by 10.2') is one of the prettiest galaxies of the southern sky, showing a bright bar cutting through its central bulge and arcing spiral arms attached to the bar's ends, all set in a colorful and rich field of stars.

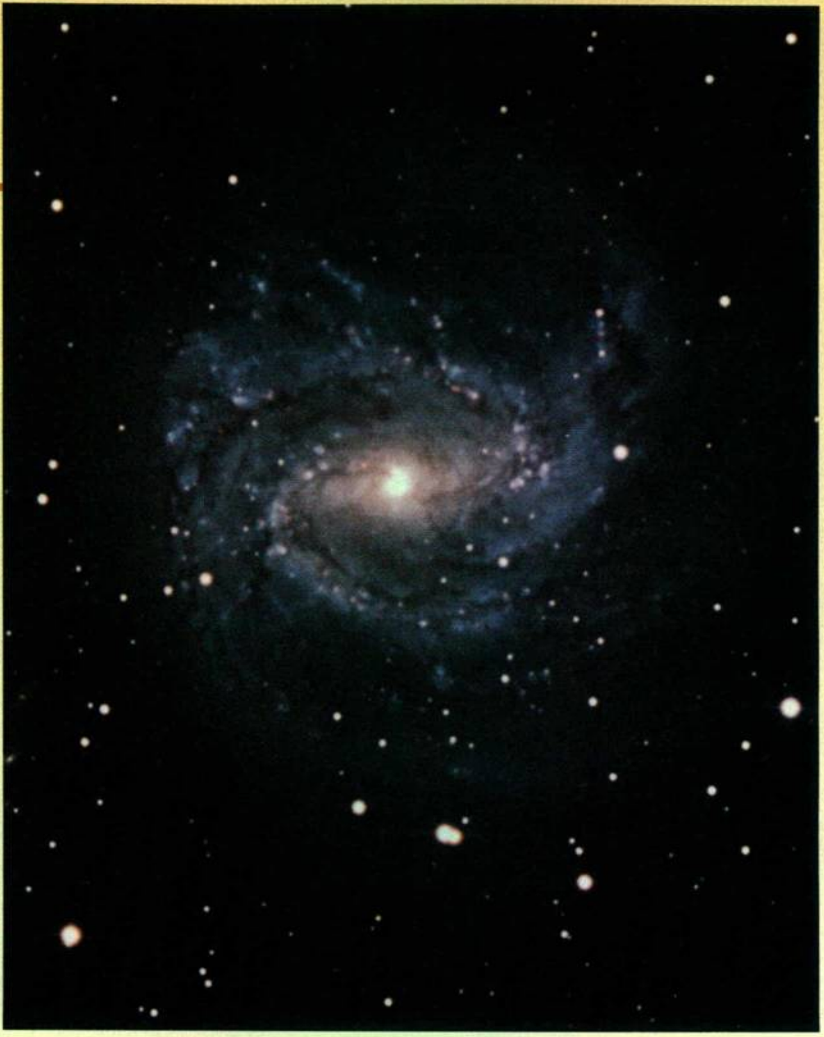
Far to the east, in Cepheus, lies another remarkable

M100 in Virgo
Mag. 9.4, Size 6.9' by 6.2'
25-inch f/5 reflector, ST-6 CCD camera

by Jack Newton

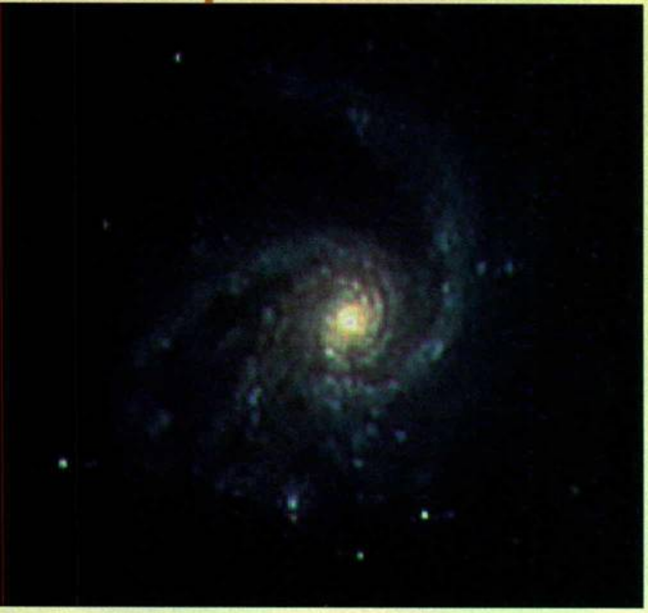
M83 in Hydra
Mag. 8.2_B, Size 11.2' by 10.2'
20-inch f/5 reflector, hypersensitized
Ektar 100 film, 90-minute exposure

by Andrew Peters



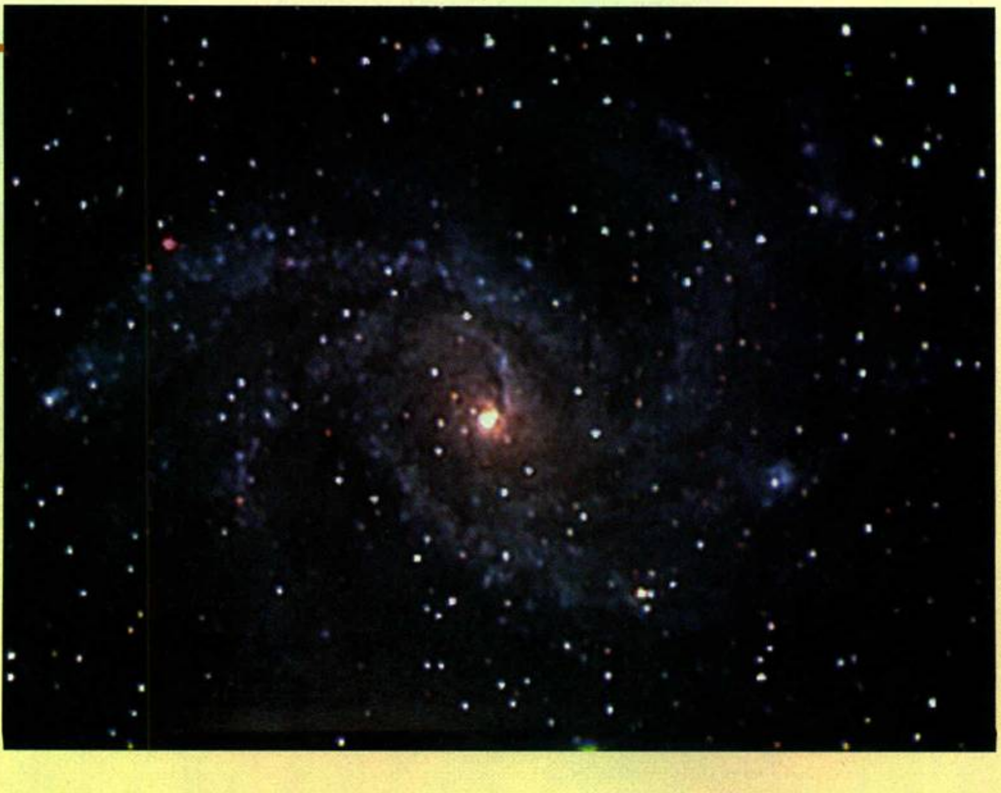
M99 in Coma Berenices
Mag. 9.8, Size 5.4' by 4.8'
25-inch f/5 reflector,
ST-6 CCD camera

by Jack Newton



NGC 6946 in Cepheus
Mag. 8.9
Size 11.0' by 9.8'

by Jack Newton



The Whirlpool Galaxy (M51)
Mag. 8.4,
Size 11.0' by 7.8'
16-inch f/4.5 reflector, hypersensitized Tech Pan film, tricolor composite made from 65-minute red, 90-minute blue, and 125-minute green exposures

by Bill and Sally Fletcher

spiral appearing in a rich field of stars. **NGC 6946** (mag. 8.9, size 11.0' by 9.8'), located 2° south-southwest of 4th-magnitude Eta Cephei, offers a pinpoint nucleus surrounded by a large, faint glow. An 8-incher on a dark night reveals the wispy spiral arms of this ghostly object.

As the summer Milky Way returns to the early morning sky, you now have a break from observing galaxies. But as the first stages of dawn build in the east, constellations such as Triangulum and Pisces strain to bring the autumn sky's galaxies over the horizon. You may elect to save them for the coming weeks, when they will climb higher into the morning sky. But you may catch a glimpse of them now. The spirals **M33** (NGC 598) and **NGC 925** in Triangulum and **M74** (NGC 628) in Pisces will provide you with satisfying viewing. For now, take heart in the many forms of the springtime spirals, and take special care to spot details in the brighter face-on galaxies such as the Whirlpool, M33, NGC 6946, M100, and M83. The amount of detail in their centers, spiral arms, and outer haloes will make them old friends. Over time you'll certainly note more and more, a sure sign that your eye is growing more and more keen. □

M101 in Ursa Major
Mag. 7.7, Size 26.9' by 26.3'
12-inch reflector, STAR-I CCD camera, 160-second exposure

by Keith Snyder, Steve Messner, Bob Elliott, and Paul Nelson

Alan Goldstein is a geologist at the Falls of the Ohio State Park in Clarksville, Indiana. He has written many observational articles for Astronomy.

Glows Bands & Curtains

A particle breeze from the Sun hits Earth's atmosphere. The result? A light show that's sometimes subtle, sometimes awesome, and always fascinating.

by John Shibley

Northern lights are many things to many people. Some native cultures in North America consider them spirits on a journey to another world. Western folk wisdom dictated aurorae were the reflection of sunlight off polar ice. Many urban dwellers often confuse them with light pollution. But to aficionados of the night, far away from the glare of city lights, the northern lights are an atmospheric light show taking wing in the form of glows, bands, and curtains. For an avid watcher, varied forms of aurorae are as much fun to observe and photograph as any deep-sky object or lunar vista.

Northern lights result when charged particles from the Sun plow into our planet's upper atmosphere as they follow Earth's magnetic field. A display's brilliance and longevity depend on how much stuff the Sun spews toward Earth. Its shape depends on how these particles interact with Earth's magnetic field. And its color provides clues about the nature of our atmosphere and the speed of culprit particles.

In Living Color

For the most part, northern lights look green. Electrons and protons from the Sun, accelerated by Earth's magnetic field up to speeds of 37,000 miles a second, smash into oxygen atoms more than 60 miles up, causing the atoms to glow green (scientists call this a color type C aurora). Slower-moving particles don't travel as deep into the atmosphere and hit atoms 120 miles high to create the red light of color type D aurorae. Green aurorae with top fringes of red (color type A) are caused by a mixture of slow- and fast-moving particles. If the particle stream is especially energetic, green aurorae sometimes sport red bases (color types B and E), caused by collisions with nitrogen 42 miles up. And if there's a Moon out or lingering twilight, try looking for still another color. Sunlight (moonlight is sunlight reflected from the Moon) causes upper atmospheric nitrogen ionized by particles to glow blue or purple (color type F).

Bands, Arcs and Blobs

But by far the most obvious feature of aurorae is form, which falls into two distinct categories: discrete and pulsating.

The most easily seen aurorae are discrete, characterized by their sharp boundaries. Common discrete forms include isolated bands and arcs; the latter have curved, symmetrical bottoms that span the horizon. Both are 100 or 200 miles tall but only 300 feet thick. Homogeneous bands and arcs do not display detail and look like a continuous glow of light. But draperies can form in both, giving them an undulating appearance.

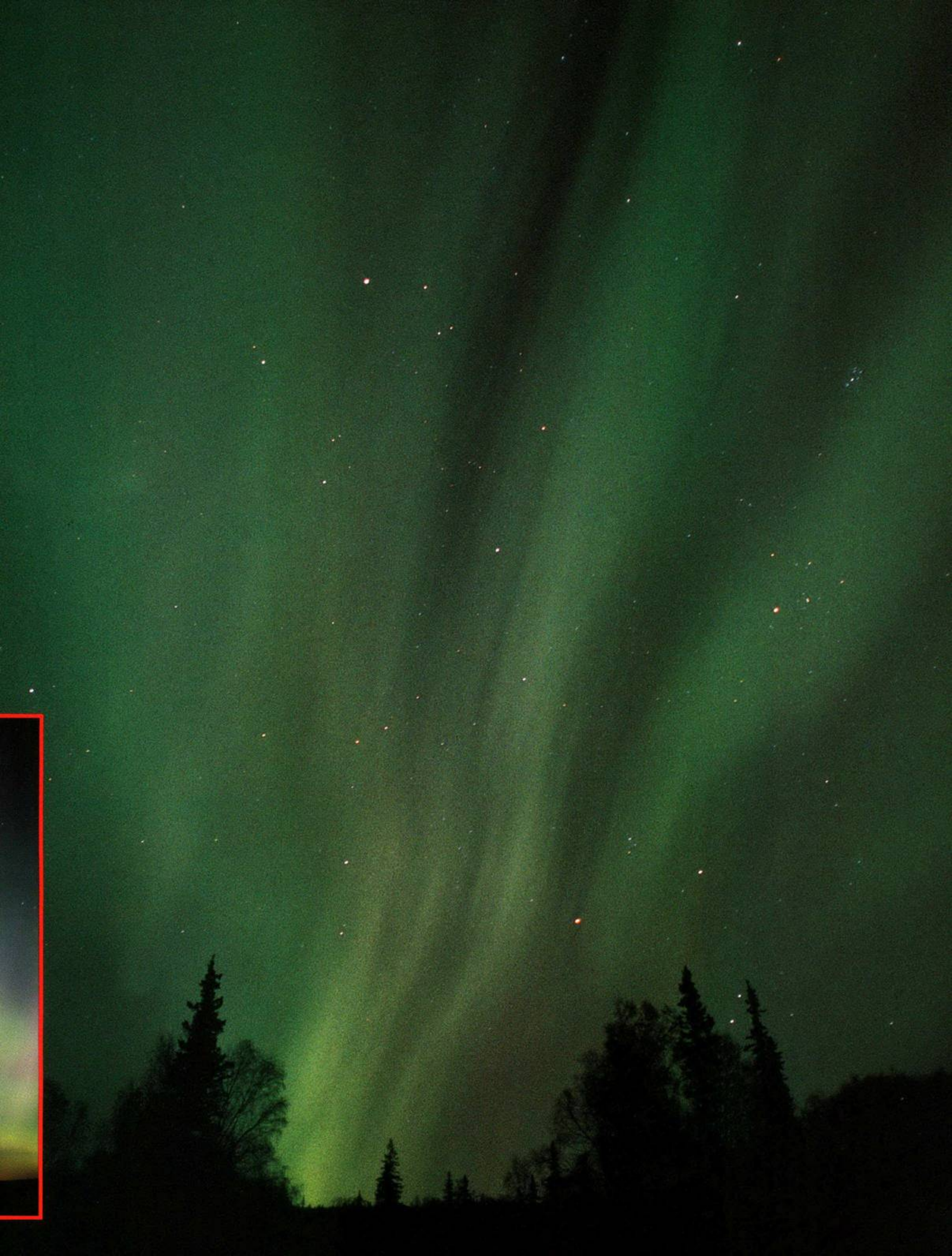
Distinct segments, called rays, sometimes show up in discrete aurorae. These rays line up with Earth's magnetic field lines. A rayed arc that's low in the north is often called a picket fence aurora. If a section of discrete aurora folds upon itself, or spirals, it appears to momentarily

John Flinn

BITS OF THE SUN give us a sky light show we call aurora. Our planet's magnetic field traps particles ejected from the Sun until they spiral down toward Earth's surface. Those that dig down to within 60 miles of Earth's surface cause oxygen to glow green, creating a color type C aurora (far right). Nitrogen ionized by particles and then struck by sunlight produces a blue or purple aurora, color type F (below, right). Extra-energetic particles travel deeper, as low as 42 miles, and cause nitrogen molecules to glow red at the base of the aurora, producing a color type B display (below). Each of these photos shows the rayed band form of discrete aurora.

Jay Brausch

Claude Marcotte



brighten. In that area of the band or arc, the spiral is about 3,000 feet thick. Bright, discrete aurorae that form a spectacular crown overhead are called coronal. For the most part, discrete aurorae are active before midnight and often mark the peak of a display.

At peak display, bands and arcs undergo flickering, varying in brightness up to seven times a second. When the display, is flaming, fast-moving waves of brightness move up the aurora's length from its bottom. Lurking between brighter portions of the display might be bean-shaped pockets where there is no aurora light at all; these pockets are coined dark aurorae.

All these features signal an outburst's peak. When things start to settle down, a second category of aurora dominates, pulsating aurorae. Common after midnight or toward the end of an active display, these have ill-defined boundaries. Their most obvious feature is a cyclical change in brightness, which varies anywhere from a tenth of a second to 20 seconds. To spot this aurora, lock your eyes on one section of the sky and try to spot blobs of light blinking in and out of view. Where a discrete display might last for several minutes, pulsating aurorae persist for hours.

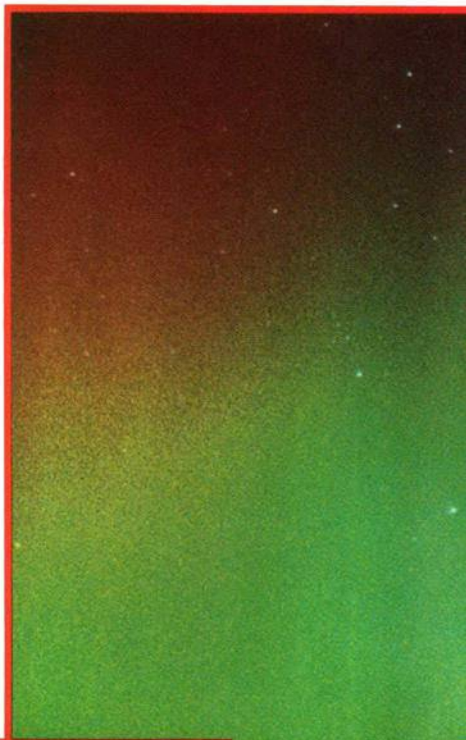
There is a third, more elusive aurora subtly visible during peak discrete displays: the hydrogen arc. For the most part, particles spiraling along Earth's magnetic field are responsible for the two most common forms of aurorae. Hydrogen arc aurorae, on the other hand, are caused by particles, mainly protons (hydrogen atoms missing their electron) that leach into the upper atmosphere from Earth's radiation belts. To spot hydrogen arc aurorae, look for a uniform, non-pulsing, colorless band no brighter than the Milky Way to the south of a discrete display.

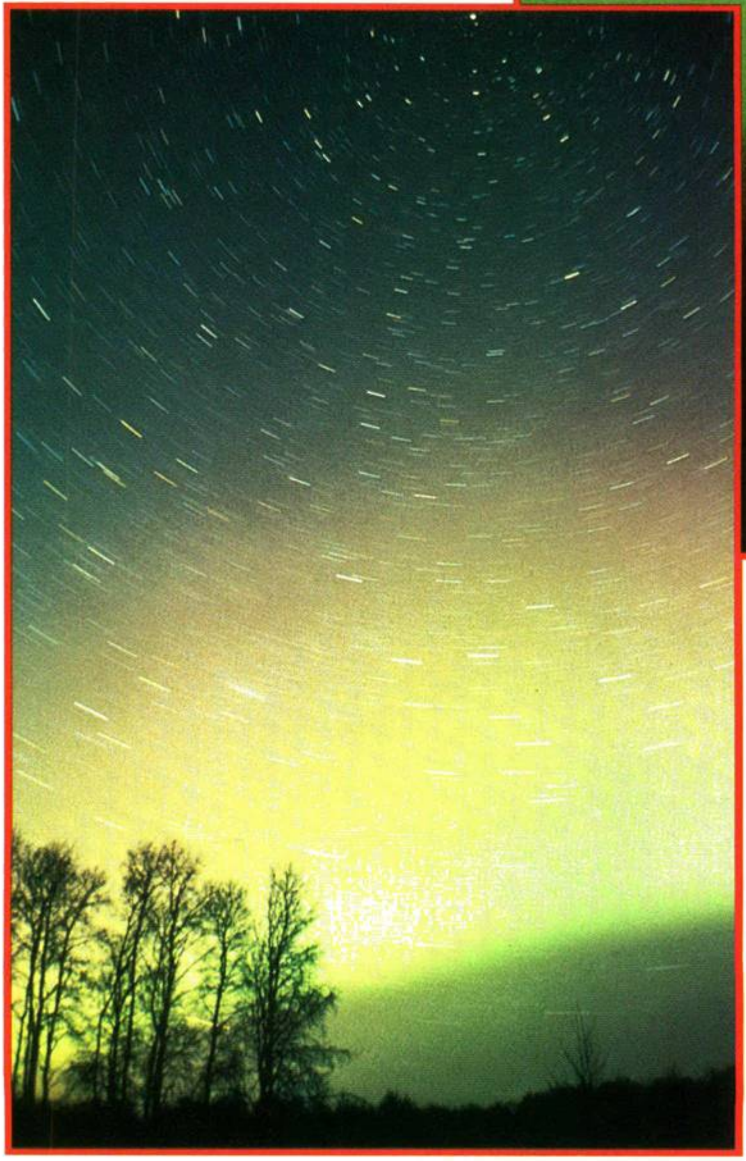
Look North for Aurorae

Seeing the northern lights depends on where you live and how active the Sun is. Particles that cause aurorae dive toward the magnetic north pole, located off the Perry Islands of Canada, at latitude 77° north. They won't reach the ground because Earth's atmosphere gets in the way, so they create an 2,500-mile-wide auroral oval centered on the magnetic pole.

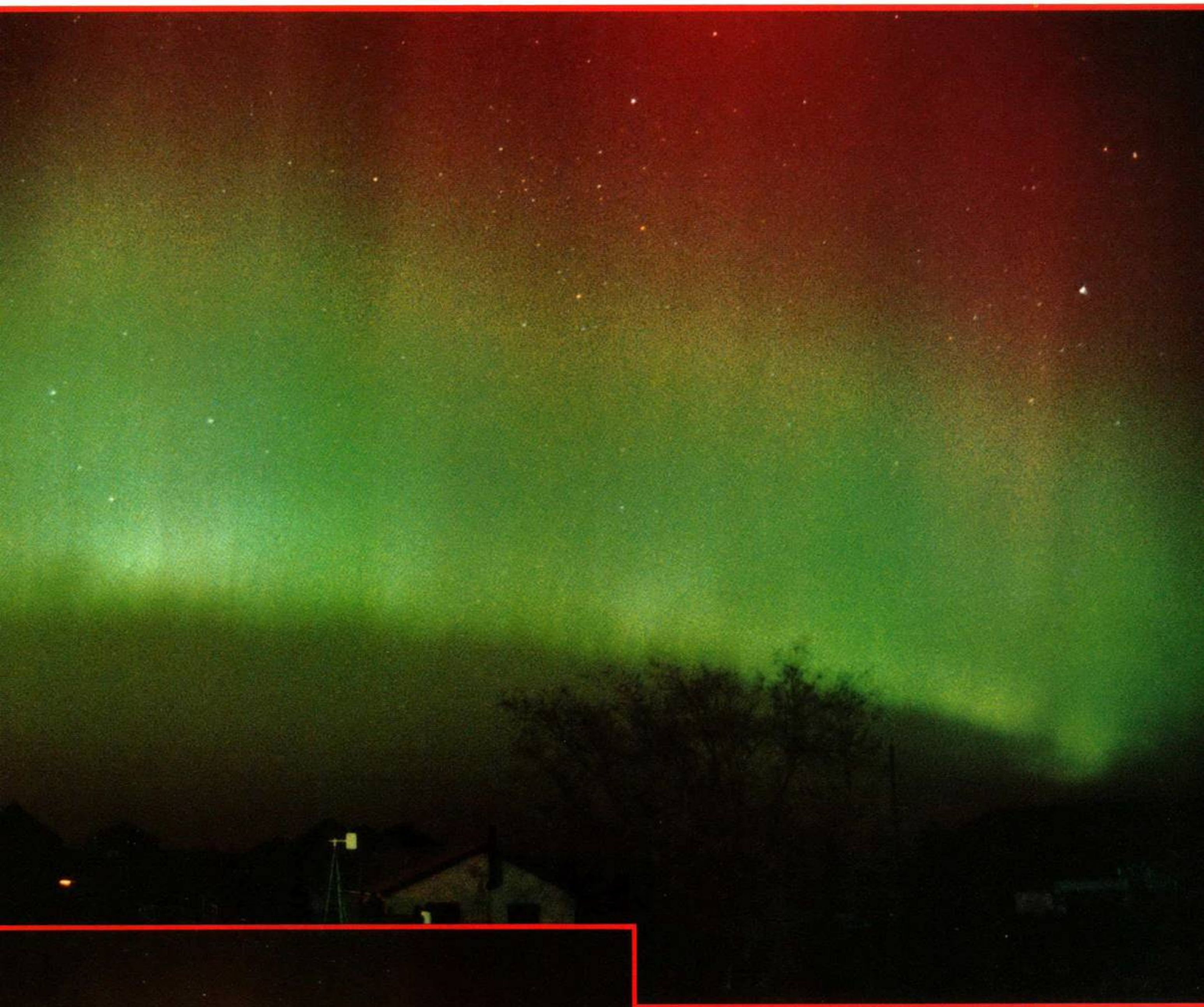
People who live under the fringes or inside the radius of this oval have a better chance of seeing aurorae than those who live farther south. Because the Sun always drizzles particles, the auroral oval is always present, and Alaskans and northern Canadians see displays almost every clear night. Those in the midlatitudes might see northern lights three to five nights a year, but far-southerners such as Floridians, southern Californians, and Texans see displays only once a year.

People that far south see aurorae only after the Sun has a massive outburst of particles generated by some solar flares. While Earth's upper atmosphere comes under such an assault, the auroral oval creeps farther south. Where folks in the north-

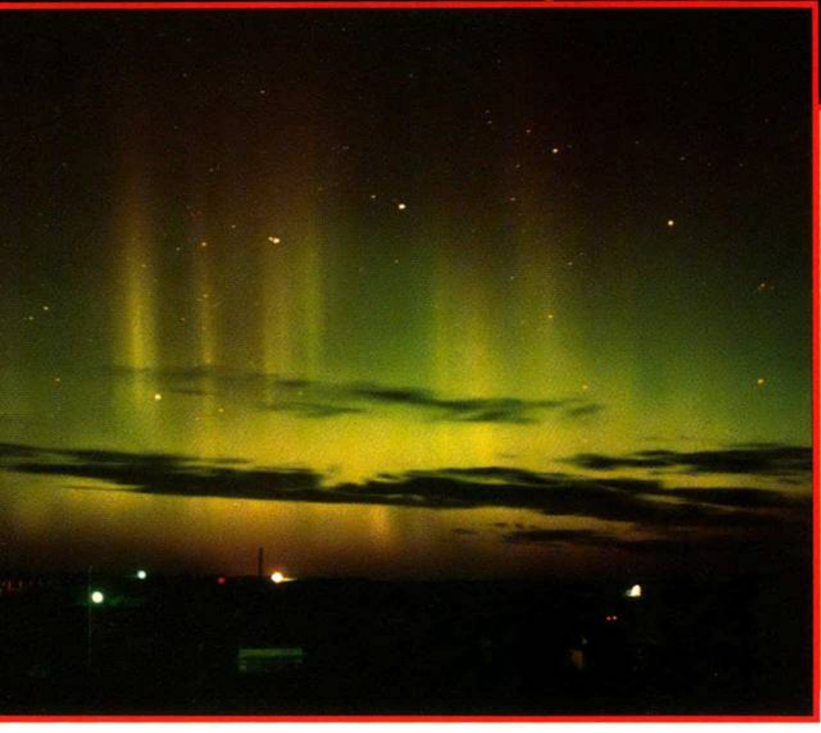




Russ Sampson



Jay Brausch



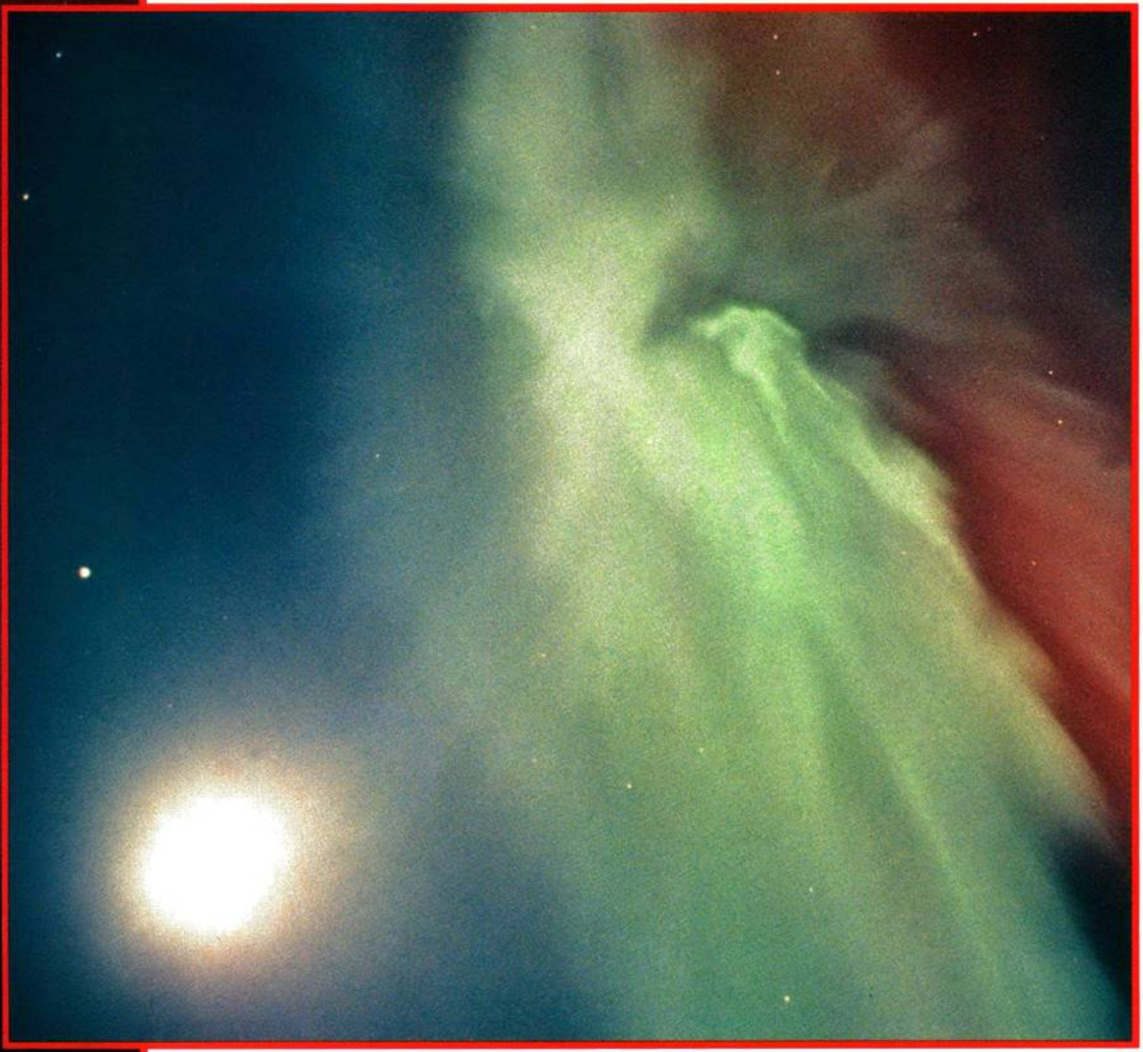
Jay Brausch

AURORAE CROWNING the north in a continuous glow from horizon to horizon are called arcs. Interplay between Earth's magnetic field and charged particles from the Sun leads to variations on the arc theme. Homogeneous arcs look smooth and featureless (far left), while rayed arcs are rich in shimmering segments (above). Arc aurorae low in the north with loose segments of rays are called picket fence aurorae (left). With color type A aurorae (pictured on these two pages), less energetic particles make upper atmosphere oxygen glow red; oxygen deeper in the atmosphere glows green. Data for all the photos in this article appears in "Resources and Photofacts," toward the back of the magazine.

Tom Polakis

AURORA STORMS RICH in red give people in southern latitudes an occasional treat. An abundance of low-energy particles make 120-mile-high oxygen glow, creating the all-red color type D aurorae. A photographer in Kentucky recorded a type A aurorae (green aurorae very low in the north look orange) awash in a "sea" of type D (above). From the desert southwest (right), a type D display created an eerie northern horizon. For northern observers, the active display forms a corona (opposite page, right). This photo shows a color type B aurora as viewed from underneath. Voids between bright ripples are dark aurorae; to the left are the Moon and Jupiter.

Jim Baumgarten



Russ Sampson

ern latitudes see a spectacular display, those in the south might spot an unanticipated red glow to the north. (During an active display in World War II, Californians thought they were under a Japanese air attack.)

Spectacular displays are predictable because particle streams from a solar flare take about three days to reach Earth. Besides creating aurorae, particle influxes also wreak havoc on Earth's ionosphere and magnetic field, causing electrical and radio communication blackouts. Scientists scrupulously monitor solar activity and issue warnings when there's an outburst. You can monitor these special notices by calling the Space Environmental Service Center's solar hotline at (303) 497-3235, or listen to shortwave radio station WWV (5, 10, and 15 MHz) for updates at 18 minutes after the hour.

When forecasters predict a geomagnetic storm, be on the lookout for an upswing in auroral activity. If you do see a great display, note the date and watch the skies about a month later, when the Sun's 27-day rotation brings the active region on its surface back into line with Earth.

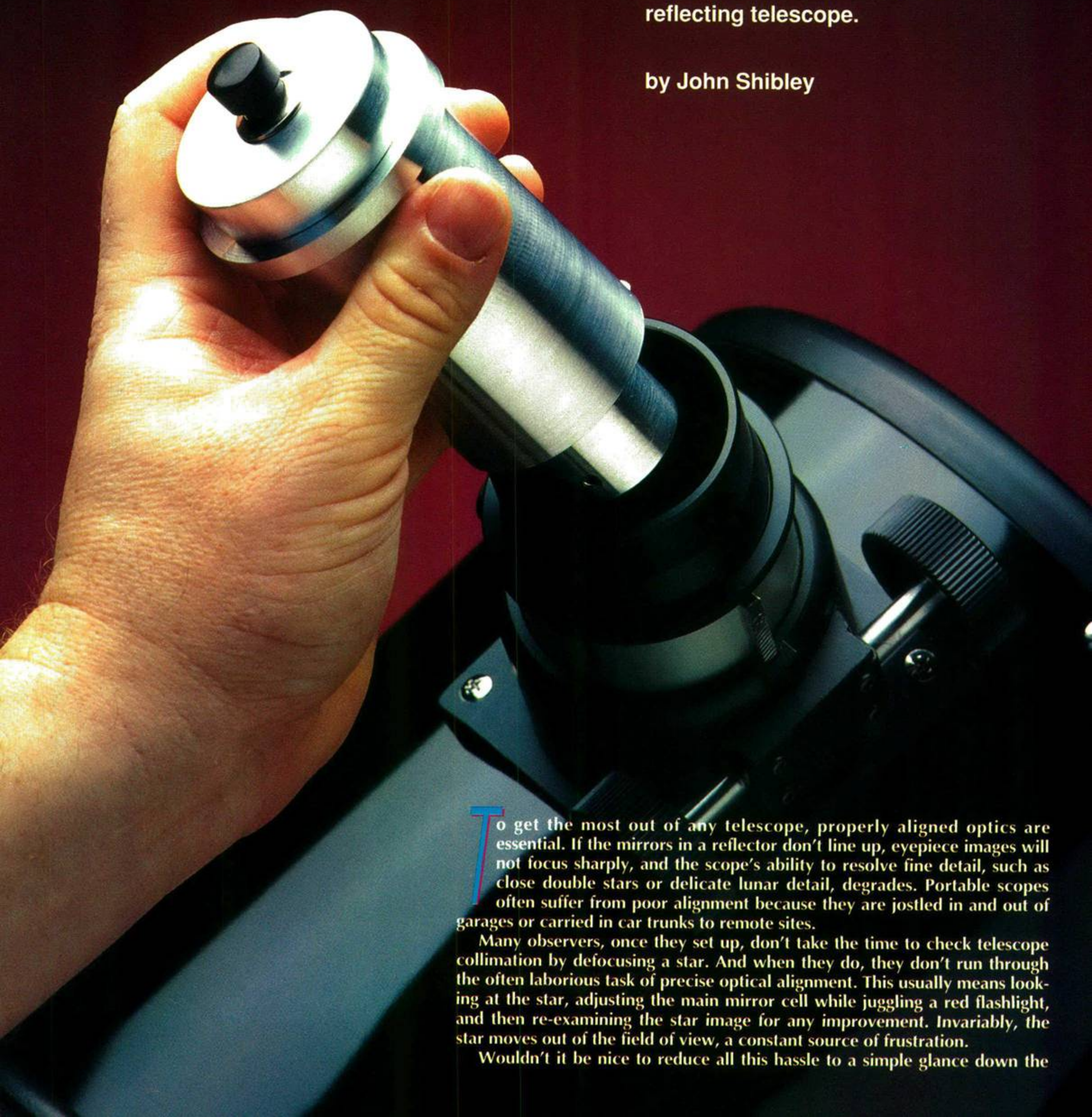
Regardless of whether Earth withers under a geomagnetic storm or copes with its usual dose of Sunstuff, you may want to photograph aurorae. Load a camera with ISO 400 or 800 film and set it on a tripod. Use a 50mm (or wider) lens focused at infinity, set to its lowest f-stop number. With the camera's shutter speed set on "B" or "T," use a cable release to take 30-second exposures. For bright, fast-moving displays, shoot short 5- to 15-second exposures. Leave the shutter open several minutes to record faint aurorae that often lie low in the north.

Northern lights remind us that it's an unforgiving universe out there. Indeed, if not for a thin blanket of air between us and charged particle streams from the Sun, we wouldn't be here to enjoy and photograph nature's light show. So on chilly spring evenings, keep a sharp eye to the north, curl up in a blanket or sleeping bag under the starry sky, and enjoy. ☐

ALIGNMENT BY LASER LIGHT

This handy collimating tool makes it a snap to fine-tune the optics of a reflecting telescope.

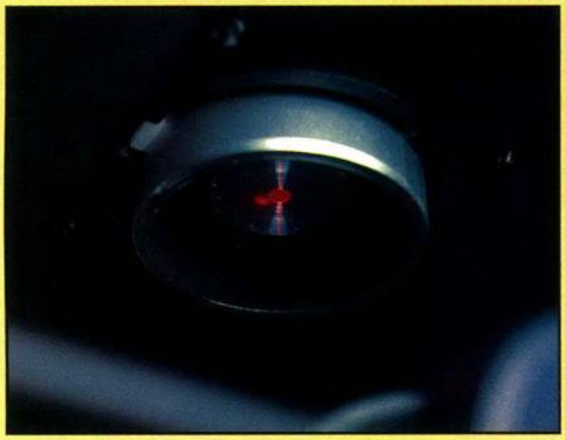
by John Shibley



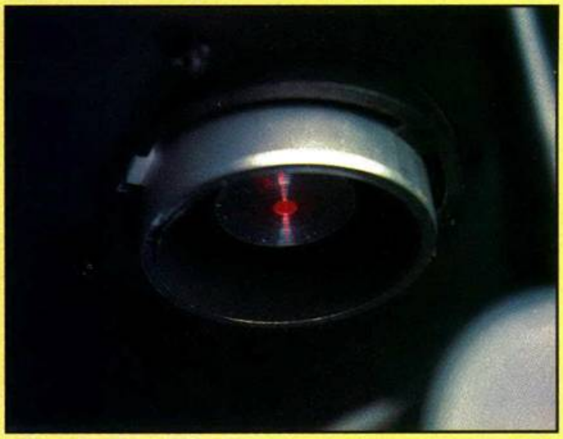
To get the most out of any telescope, properly aligned optics are essential. If the mirrors in a reflector don't line up, eyepiece images will not focus sharply, and the scope's ability to resolve fine detail, such as close double stars or delicate lunar detail, degrades. Portable scopes often suffer from poor alignment because they are jostled in and out of garages or carried in car trunks to remote sites.

Many observers, once they set up, don't take the time to check telescope collimation by defocusing a star. And when they do, they don't run through the often laborious task of precise optical alignment. This usually means looking at the star, adjusting the main mirror cell while juggling a red flashlight, and then re-examining the star image for any improvement. Invariably, the star moves out of the field of view, a constant source of frustration.

Wouldn't it be nice to reduce all this hassle to a simple glance down the



WHEN A SCOPE'S OPTICS aren't aligned, the collimator's reflected beam misses the laser's opening. This view looks down the scope's tube.



WHEN THE OPTICS are aligned, the beam reflects directly back upon itself. The optics are now tuned to provide peak performance.

telescope tube? It would be even more convenient to collimate in daylight, when you don't need a red flashlight to see adjustment screws. Well, there is just such a solution and it harnesses the clarion light of a laser.

The AstroSystems laser collimator slides into a 1¼-inch or 2-inch focuser. It emits a tiny point of laser light that bounces off a reflector's secondary mirror to the primary and then back to the secondary and up to the focuser. The beam's reflection shows up as a tiny dot of light on the end of the collimator that sticks out from the bottom of the focuser. This reflection serves as a guide during mirror adjustment: When it lines up with the collimator's laser hole, the telescope's optics are perfectly aligned. Simple . . . that's it! Best of all, because the laser reflection is so bright, this quick alignment procedure can be done in broad daylight.

The collimator uses a 5 milliwatt, Class IIIa red laser that emits in the 670 nanometer range. It is powered by three AA batteries that AstroSystems recommends be changed every two years to keep them fresh. The laser turns on and off through a push-button switch on one end of the collimator. A machined-aluminum housing contains the laser and batteries, with screws allowing easy access to the battery and laser compartment.

Weighing 13.5 ounces, about as much as a typical 2-inch eyepiece, the collimator is 5¼ inches long and two inches wide for most of its length. The final inch of its length is 1¼ inches in diameter, which allows the collimator to fit scopes with 1¼-inch focusers.

As the instruction manual points out, laser-assisted collimation assumes that a telescope's optics are in rough alignment, for the laser beam must reflect back to the collimator. If the optics are grossly out of alignment, the beam might miss the secondary mirror completely.

Because this is an important point, most of the collimator's instruction booklet is devoted to optical alignment techniques. It describes how to square the focuser with the telescope's tube (a task the laser helps you with), how to offset the secondary mirror from the focuser, and how to line up the primary mirror. (For more on how to align Newtonians, see "How to Collimate Your Telescope," April 1992.) These forms of rough alignment are usually done after assembling a scope for the first time, or after it has been grossly knocked out of collimation. If the scope is handled carefully, coarse alignment need only be done once. Thereafter, all that's needed for optimal alignment is the laser collimator.

During precise collimation, owners of high-profile focusers (focusers that stick out several inches from the telescope tube) might have to look for the collimator's laser-end reflected in the primary mirror, because the collimator might not be long enough to stick out the bottom of the focuser.

The laser collimator comes in handy for other scope adjustments and uses. Tapping each vane on the secondary mirror holder and seeing how much the reflected beam wiggles verifies that all the vanes are tightened evenly. By noting other movements in the laser reflection, observers who ventilate their telescopes can make sure there aren't any unwanted vibrations induced by small electric fans. Other applications of the tool include using it as a pointer during talks and slide presentations, or when identifying constellations on humid nights.

While this laser is not hazardous enough to warrant eye protection, you shouldn't look directly into the collimator where the laser comes out. Quick glances will, at the very least, ruin night vision for a while. Keep this caveat in mind while searching for a beam reflection in what could be a telescope that's grossly out of optical alignment.

The beauty of AstroSystems' laser collimator lies in its convenience and versatility. The tool's compactness means it can fit next to eyepieces in a carrying case. For the price of a premium-quality eyepiece, it provides a quick method of verifying the optical collimation of any reflecting telescope. This, coupled with its other uses, makes the laser collimator a highly useful accessory for any observer. □

The AstroSystems Laser Collimator: $169
AstroSystems
5348 Ocotillo Court
Johnstown, CO 80534-9322
(303) 587-5838, fax (303) 587-4613

ASTRONOMY'S MARKETPLACE

Welcome to the MARKETPLACE section in ASTRONOMY Magazine. These pages are specifically designed to be an affordable and highly effective way for you to market astronomy-related products or services. Call **Debbi Simon** at **800-558-1544, ext. 636** to place your advertising message here.

ECLIPSE CRUISE

OCT. '95 S. E. ASIA
ON THE MARCO POLO OF ORIENT LINES
CALL CBH TRAVEL
ORIENT LINES **(415) 282-7728**

JSL

INTRODUCES THEIR NEW NEWTONIAN UPGRADE SYSTEM

THE ULTIMATE SOLUTION
FOR RIGIDITY & TRACKING PROBLEMS
ASSOCIATED WITH DOBSONIAN & SHAKY
TRIPOD MOUNTED NEWTONIANS
SHOWN WITH DOBSONIAN TUBE

INTRODUCTORY SPECIAL
$2,919.95
10" & 12-1/2" MODELS
INCLUDES: MOUNT, BATTERY & CHARGER
SPLITRING EQUATORIAL WITH TRACKING
ACCEPTS ALL NEWTONIAN-STYLE TUBES
50 MOUNTS IN STOCK NOW
COMPLETE SCOPES AVAILABLE WITH
PREMIUM NOVA OPTICS
CALL FOR FREE CATALOG

PREMIUM CRAYFORD DESIGN FOCUSER

INTRODUCTORY SPECIAL
$189.00
2" MODEL WITH 1-1/4" ADAPTER
NO EXTRA CHARGE

JSL
P.O. BOX 51, WILLARD, UT 84340
PHONE/FAX: 801/723-5568
SHIPPING AND HANDLING WILL BE ADDED TO ALL ORDERS
VISA & MC ACCEPTED
CASH DISCOUNTS AVAILABLE

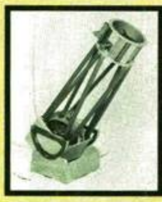
METEORITES

ROBERT A. HAAG METEORITES

All varieties.
Authenticity and satisfaction guaranteed.

Send $5.00 for a 64 pg, full-color, all-new *Field Guide of Meteorites*. Cost refundable on first order.

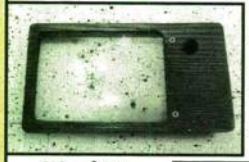
To fax: (602) 743-7225
P.O. Box 27527, Tucson, AZ 85726



EXPERIENCE THE DEEP SKY!
STARSPLITTER TELESCOPES
HIGH QUALITY ALT-AZ NEWTONIAN TELESCOPES 12.5" - 30". COMPLETE SYSTEMS OR INSTALL YOUR OPTICS
FOR INFORMATION CALL OR WRITE
805-493-2489
3228 RIKKARD DR.
THOUSAND OAKS, CA 91362

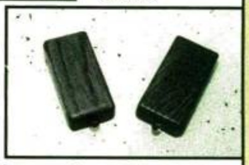
Observer's Chair $79.95 ($10 s/h in US)
Observer's Table $79.95 ($17.50 s/h in US)

★ Easy Storage - Lightweight (under 10 lbs.)
★ Chair is 36" tall - Adjustable seat moves 18" to 36" (Max. weight 250 lbs.)
★ Tabletop is 18" x 30" standing 33" high (Collapsible for easy storage)



A.I.M.
Astronomical Illuminated Magnifier
★ $34.95 ($3.50 s/h in US)
★ Uses 2 - 10mm Red Dif LED lights
★ Illuminates & magnifies star charts

Wood Lite
★ $19.95 ($2.50 s/h in U.S.)
★ Jumbo Red diffused mercury switch
★ Jumbo waterclear Red LED with low, med. and high intensity



Glow in the Dark M-51
★ $17.50 ($2.50 s/h in US)
★ Available in M, L, XL & XXL (Add $1 for XXL)

Sheet Magnifiers available in various sizes
★ Set for $10 (+$1.50 s/h in US)

Visa/Mastercard accepted

All Products Hand-crafted Solid Oak
K.C. Woodsmith • P.O. Box 75033
Wichita, KS 67275-0033
Phone (316) 721-1566

" YOUR GATEWAY TO THE STARS"

High quality Truss Tube Newtonians with features that will blow your mind without blowing your wallet.
12.5" - 25" sizes.

GATEWAY TELESCOPES
4339 Delor St. • St. Louis, MO 63116
(314) 752-1982

Buy a Star ★ Name a Star

On the exclusive
MSAS Star Atlas
to be placed in our future observatory & science center.

Starting at only $30.00 !
Free brochure.

Receive a certificate of record and more. **(909) 336-1699**

Mtn. Skies Astronomical Society
Box 1169 - Lake Arrowhead, CA. 92352
VISA/MC accepted

NASA Photo
FOR SALE

We've got an easier way to sell your scope

The Starry Messenger astronomy classified shopper is the largest nation-wide listing of the telescopes and accessories currently for sale by amateur astronomers.

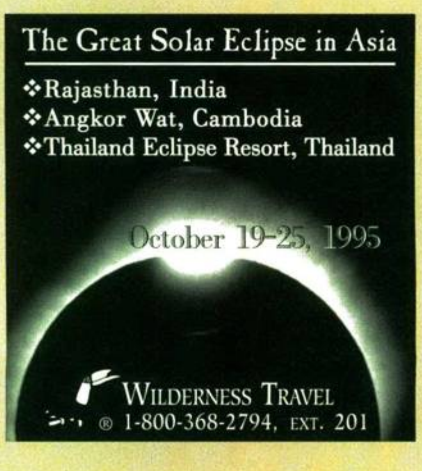
Advertise free - pay a 4% commission when successful
Subscribe - $23 for 12 issues
Save $$$ on used equipment
Over 20,000 sales since 1986
500+ current ads each month

The Starry Messenger PO Box 6552-A Ithaca, NY 14851
(201) 992-6865 FAX (607) 277-0018 CompuServe 75020,3120
MC / VISA / DISC Canada - Mexico please send $29 US funds

BUSINESS OPPORTUNITY

Earn up to $500 per day doing Astronomy programs with a Starlab portable planetarium!
Initial investment as low as $9450.00.
Call or write for information package and other help starting your own business with Starlab.

Learning Technologies, Inc.
59 Walden St. • Cambridge, MA 02140
Ph: 800-537-8703 • Fax: 617-547-2686



The Great Solar Eclipse in Asia

❖Rajasthan, India
❖Angkor Wat, Cambodia
❖Thailand Eclipse Resort, Thailand

October 19-25, 1995

WILDERNESS TRAVEL
® 1-800-368-2794, EXT. 201

ASTRONOMY'S

MARKETPLACE

DO YOU HAVE ASTIGMATISM?

NOW YOU CAN OBSERVE WITHOUT GLASSES!

- Your astigmatism corrected with our CUSTOMIZED LENSES
- Get DRAMATIC RESULTS with binoculars, RFT's, low-powers!
- Lens inserts over, or into 1.25" or 2" eyepiece, or into binoculars
- Premium quality, multi-coated (T=99.5%) ophthalmic lenses
- Retains full eye relief and field of view • Starting at $59.95

Custom Opthalmics, 11603 Hampstead Dr.,
Fredericksburg, VA 22407, Voice/fax 703-786-9276 24 hours

TOTAL SOLAR ECLIPSE
Angkor Wat Cambodia
including Phnom Penh, Hong Kong & Bangkok
Oct 18-27
complete package from $2995
Join noted Astronomer & Author
Dennis Mammana
Reuben H. Fleet Planetarium Director/Resident Astronomer
& Bob Parda-Travel escort

Advantage Travel & Tours
Specialist in travel to Cambodia
(inquiries from groups/organizations welcome)
16935 W. Bernardo Dr. #107 San Diego, CA 92127
(619) 674-2288 **800 882-2098** fax (619) 674-2266

FREE LIST OF AVAILABLE SPECIMENS

METEORITES

- **New Miles IIE Silicated Iron**
- **Pallasites and more**

Authenticity and Satisfaction Guaranteed

BUY • SELL • TRADE

Southwest Meteorite Lab
P.O. Box 95 • Payson, AZ 85547

FAX 602-474-2474

Publish Your Book

70-year tradition of quality. Subsidy book publisher offers publishing services for books of all types. For *Author's Guide* write or call Dorrance—AST-D, 643 Smithfield, Pittsburgh, PA 15222 or 1-800-695-9599.

Shoemaker-Levy
Comet
Collision with
Jupiter
CD-ROM

$19.95 + $3 S&H

- Over 350 images
- Most in color
- 16 animations

For Macintosh & Windows Computers

Geppetto & Son, Inc.
800 Martin St.
Longmont,
CO 80501

MasterCard/VISA
(800)269-2605
fax: (303)346-4003

AstroSystems
Truss Tube Kits & Components
Including: Primary Mirror Cells, Spiders, Focusers, Sec. Holders, Tube Clamps, Altitude Bearings, Teflon, Ebony Star, Kydex
Free catalog US; foreign $2.00 refunded w/first order
5348 Ocotillo Ct., Johnstown, CO 80534/303 587-5838

It's a Ball!

- Fits in any car
- Quick set-up
- Comfortable viewing & slewing

Exceptional 12.5" f/5 Optics
Rotatable Tube
Needs No Ladder

PortaBall 1

Call for a flyer

MAG 1 INSTRUMENTS
16342 Coachlight Dr.
New Berlin, WI 53151
414-785-0926

BURBANK
TELESCOPE
COMPANY

P.O. Box 7562
Burbank, CA. 91505
FAX 818-783-9469

Send $5.00 for our catalog package

TOTAL SOLAR ECLIPSE
ARUBA FEB. 26, 1998

3:20 totality, longest till 2001.
Aruba, a desert island, almost no cloud cover. Reserve now with a $20 deposit. Stay at the Aruba Sonesta Resorts at Seaport Village.
Aruba is a small island and will sell out fast.

INNOVATIONS IN TRAVEL, INC.
800-733-3361

ANGORA≅SPORT
NEW, LUXURIOUSLY SOFT, WARM AND ALL NATURAL
made from
COTTONANGORA
"a cuddly, cozy,
can't wait to feel it, new textile."

STAY WARM NATURALLY

COZY ALPINE THERMALS

Alpine Top only $48.95

Thin, Soft, Luxuriously Warm
DURABLE!
Preshrunk, throw it in the washing machine and then in the dryer.
CAREFREE!

Completely Natural
Environmentally Safe
45% Organic Cotton
55% Angora
COLORS
Natural White, Berry, Forest, Denim, Charcoal, Black.
SIZES
Men's:
S, M, L, XL, XXL
Women's:
XS, S, M, L, XL

Alpine Leggings only $38.95

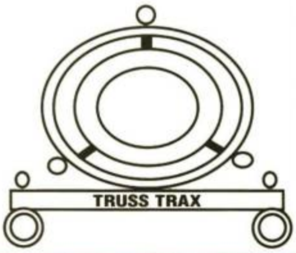
Cozy Alpine Thermals ≡ Top & Leggings
save 10% $78.95

TO ORDER ≡ CALL
1 800 79-ANGORA
FREE MULTIWEAR BROCHURE
Call or send check payable to:
COTTONANGORA TRADING CO.
1555 Highland Ave., Cheshire, CT 06410
ALL MAJOR CREDIT CARDS ACCEPTED
please add $2.95 per item for shipping/handling

• Truss Trax •

Mount your 60mm to 4 inch refractor to your truss tube telescope with *Truss Trax*. This light-weight mounting system allows you to mount your refractor between the trusses allowing this unused space to become a convenient and structural supporting area. Call or write for free info and photos.

Call or write:
Hillside Observatory
11103 Hillside
Pinckney, MI 48169
(313) 878-0438



ASTRONOMY'S

MARKETPLACE

ASTRONOMICAL ADVENTURES

"Where space and geologic times meet"

Come to Northern Arizona to explore the Universe from extraordinary dark skies and experience the Planet Earth at diverse geologic sites.

- Daily and week-long camp programs.
- Facilitated viewing with large telescopes.
- Guided tours of Meteor Crater, Sunset Crater, Grand Canyon, Lowell Observatory, and more.
- An educational and recreational vacation.

Opening soon at Meteor Crater with limited capacity. For further information, please write or call:

ASTRONOMICAL ADVENTURES
℅ Meteor Crater Enterprise, Inc.
603 North Beaver Street Suite C
Flagstaff, Arizona 86001
(205) 539-7223

MESSIER MARATHON OBSERVER'S GUIDE
Handbook and Atlas
by Don Machholz

Only $12.00 + $2.00 Pstg
CA. Res. Add Sales Tax
MakeWood Products
P.O. Box 1716
Colfax, CA. 95713
(916) 346-8963
VISA/MASTERCARD

IDENTI-VIEW™

PREMIUM GLASS SOLAR FILTERS

- HIGH QUALITY
- STRICT CONTROL STANDARDS

CLASS "A"
Color band - blue. Class "A" filters are made with the same premium quality polished glass and multi-alloy coating as Class "B". An additional steel alloy added to the coating process makes our Class "A" filters extremely scratch and fade resistant. Excellent for visual and photographic use. Light transmission is 1/1000th of 1%.

CLASS "B"
Color band - white. Class "B" filters are made with polished glass and multi-alloy coating. These filters offer great durability and will provide many years of service and enjoyment with normal use. Can be used visually and for photography. Light transmission is 1/1000th of 1%.

CLASS "C"
Color band - red. Class "C" filters are specifically coated to a lighter density (ND-4). They are for photographic use only. This filter is intended for use by professionals and serious hobbyists. Light transmission is 1/100th of 1%.

ORDERING INFORMATION

1. State scope brand and model number, aperture and outside diameter with filter class and price.
2. Make check or money order payable to **J.M.B. Inc.** All foreign checks must be payable through a U.S. bank.
3. Shipped free within the continental United States. All others add $5.50 Shipping and Handling per filter. Michigan residents add 4% sales tax, allow 2-3 weeks for delivery.

For more information see our ad in Observers Guide to Astronomy '95

VISA **J.M.B. INC.** MasterCard
20762 Richard • Trenton, MI 48183
(313) 675-3490 • Fax (313) 285-3015

METEORITES!

Irons. Stones. Stony-irons. Tektites.
Quality display and study specimens.
Space jewelry, books, slides.
Authenticity guaranteed.
Color Catalog $2.

Bethany Sciences
P.O. Box 3726-A
New Haven, CT 06525
CATCH A FALLING STAR!
(203)393-3395

CENTRAL CAMERA CO.

230 So. Wabash Chicago, IL 60604

1-312-427-5580
1-800-421-1899
(OUTSIDE 312 & 708)
FAX: 1-312-427-1898

WE SELL BOTH NEW & USED PHOTO EQUIPMENT AT GREAT LOW PRICES EVERY DAY! – *OUR 95th YEAR*

MON-FRI: 8:30-5:30 SAT: 8:30-5:00 (CT)

Bargain Books

Save up to 80% on publishers' overstocks, remainders. Thousands of books, from yesterday's best sellers to rarely seen titles. **Science and Astronomy,** Photography, History, Biography, Nature—over 40 subject areas. Write for **FREE CATALOG.**
Hamilton Box 15-990, Falls Village, CT 06031

ABSOLUTELY THE BEST!

To find out why, please call

1-800-499-4993

PROMPT DELIVERY
Call for Schedule

10" Z-SCOPE™ **$995.00**

Shows the serious astronomer dust lanes in galaxies, filament structure in nebulae, dozens of globular clusters as well as the moon and all the planets.

Telescope complete with TeleVue eyepiece & Telrad finder!

Manufactured in our Southwest Houston, Texas facility.

Z Optical Shop
2810 S. Main Stafford, TX 77477
Phone (713) 499-4993 Fax (713) 499-9246

START YOUR OWN PLANETARIUM BUSINESS

Order: **"HOW TO START YOUR OWN PLANETARIUM BUSINESS FOR $100.00 or MORE!"** and turn your love of Astronomy into a part or full time enterprise. A detailed start up guide, this manual will guide you in opening, running, and succeeding at your own mobile planetarium business.

Special introductory rate of only $15.00, postage paid in the U.S.

Order today from: ➡
Starlight Planetarium Productions
7406 W. Paradise Drive
Peoria, AZ 85345
(602)486-0102

SATISFACTION GUARANTEED OR YOUR MONEY BACK.

NOVA Optical Systems

High Precision Newtonian Mirrors f/4- f/10

6"	$150	8"	$225	10"	$400	12½"	$575
15"	$1,100	16"	$1,300	18"	$1,650	20"	$2,200
22"	$2,450	24"	$3,350	25"	$3,700	30"	$5,500

Fine Annealed PYREX Aluminized and SiO Overcoated

✓ **Guaranteed Quality**
✓ **Guaranteed Delivery Times**
✓ **Guaranteed Satisfaction**

P.O. Box 80062
Cornish, UT 84308
(801) 258-5699 M-F 9-7

Dallas Remote Imaging Group

Astronomy BBS

- ***Astronomy Databases***
- ***Satellite Imagery Real -time***
- ***Satellite Prediction Programs***
- ***NASA Daily Updates***
- ***Internet Space Newsgroups***
- ***Thousands of Space Images***
- ***Internet Worldwide Access***

BBS: (214) 394-7438

Voice: (214) 394-7325

Internet - info@drig.com

SINGLES NETWORK

Single people interested in science or nature are meeting through *Science Connection*.

Contact us for info: 1-800-667-5179
P.O. Box 188, Youngstown, NY 14174
e-mail: 71554.2160@compuserve.com

SOLAR ECLIPSE TOUR

Presented by
The Alberta Science Centre &
The Royal Astronomical Society of Canada, Calgary Centre.

INDIA – OCTOBER 24, 1995

- ✱ OBSERVATORY VISITS
- ✱ NEPAL EXTENSION AVAILABLE
- ✱ ESCORTED TOUR

1-800-667-9986-TEL 1-800-668-9986-FAX
IN CALGARY: (403) 265-8222

LET'S TALK WORLDWIDE TRAVEL LTD.

200, 700 6th AVENUE S.W.
CALGARY, ALBERTA, CANADA
T2P-0T8

ASTRONOMY'S

MARKETPLACE

ATTENTION MEADE LX200 OWNERS!

Now available – Pilot Base Mounting Plate

Enables quicker, safer set-up on tripod. Eliminates difficulty in finding center threaded rod hole and damage to bottom of drive base. Scope cannot slide off during bolt-up procedure. High quality appearance machined from solid aluminum plate. (Patent pending) **$215.00 + shipping**

NMA New Mexico Astronomical • 505-864-2953
834 N.Gabaldon Rd. • Belen, NM 87002

Obsessed With The Best?

We Are. Find out why nothing else comes close to an Obsession Telescope. Apertures from 15 to 30 inches. Brochure $2, Video & Brochure $5

OBSESSION TELESCOPES
PO Box 804A, Lake Mills, WI 53551
414-648-2328 Fax 414-648-2712

SEE THE TOTAL SOLAR ECLIPSE !!!

OF OCTOBER 24, 1995
- LIMITED TO 20 PARTICIPANTS -

- ✓ IN INDIA'S RAJASTHAN DESERT
- ✓ BEST VIEWING ON THE ECLIPSE PATH
- ✓ CAMP ON CENTERLINE
- ✓ SEE THE TAJ MAHAL & RIDE AN ELEPHANT
- ✓ OCTOBER 18 - 27, $2,095

Outer Edge Expeditions
(800) 322-5235 • (810) 624-5140
45500 Pontiac Tr• Walled Lk MI• 48390

New method for assembling Giant Dobsonians, (lift assemble) — 1 person can have a 150-lb. 17.5" Dobsonian assembled and supported in the rocker in 5 minutes. This portable is easier and less expensive to build and provides better performance. Detaches in 8 pieces.

Building Instruction Video and Amateur Telescope Making Journal reprint — $19.95

JAMES STEWART
314 SOUTH RIVER STREET • FRANKLIN, OH 45005

SCIENCE SOURCE

STOCK PHOTOGRAPHY AGENCY specializing in science, astronomy, space and Earth images would like to review portfolios of *talented **Illustrators** and **photographers*** for possible representation.

A Division of Photo Researchers

CALL Steve Gerard 1-800-833-9033

10' OBSERVATORY

Built by **Ash – DOME**

- Re-conditioned – Gas Heat, A/C
- Motorized, oak cab.
- Many more extras

Price New Appx. $16,500.00
Asking $8,675.00

Joliet, Il — (815) 478-5250

ECLIPSE SHADES™

Solar Viewing Glasses

Custom Imprinting Available!
ECLIPSE SHADES

Safe for direct solar viewing! Eclipse Shades™ provide the ultimate in protection from harmful Solar Radiation. Lenses made of Optical Grade, Neutral Density 5 Mylar, filter out 100% of Ultra-Violet, 100% of Infra-Red, and 99.999% of Visible Light.

Quality Paper Eyewear & Specialty Optics
Rainbow Symphony, Inc.
6860 Canby Ave. #120, Reseda, CA 91335
1-800-821-5122 FAX (818) 708-8470

FREE ONLINE ASTRONOMY CLASSIFIEDS

Buy/Sell used scopes, eyepieces, accessories, etc. Post ads immediately. See ads the second they are posted.

The Pegasus Classifieds
Online: 1-303-294-0239 (Data/Modem)
Voice (Denver Tax Software): 1-800-326-6686

The MARSFACE CD

Two original NASA images of the Marsface & Giant Pyramid taken by the Viking Orbiter SpaceCraft showing the Complete Artifact Field. 76 images have been photo-enhanced from the 2 original images showing much more detail and other potential objects. $39.95

The MARS & VENUS CD

Over 640 High Resolution Images from NASA's Viking Orbiter & Magellan SpaceCraft totalling over 660 megabytes. Has over 680 BMP Image files in total. $39.95

Get both CD's for only $64.95 + $4.95 S/H.

Other CD's available

Earthquakes – You'll see spectacular images of earthquake damage from the great 1906 San Francisco earth quake to the 1991 Iranian earthquake. You'll witness life from actual motion pictures of the aftermath of the 1906 San Fran earthquake. $29.95

Volcanoes – You'll see spectacular full screen 8 & 24 bit images of eruptions, lava flows, and damage caused by volcanoes. You'll see images of an erupting volcano on IO, one of Jupiter's moons, showing the volcanic plume. $29.95

Geology and natural Phenomena – Geological features, landslides, avalanches, geo-hazards, relief slides of the earth's surface showing crustal plate boundaries and the pacific ring of fire. $19.95

Buy all 3 CD's (a $79.85 value) for only $59.95 + $4.95 S/H and get our Space and Earth Science CD Free.
Please enclose $4.95 S&H per order
Special: get all 6 CD's (a $159.75 value) for only $99.95 and get free priority shipping

System Requirements: IBM PC Compatible/Windows
To order call 1-800-292-1414
Send check or money order to: Nick Marella
826 Northwood Ave. • Cherry Hill, NJ 08002
30-Day Money Back Guarantee

KITES

FREE COLOR CATALOG

Choose from over 200 exciting kites.
• Many unusual & innovative designs.
Call or write for your catalog today!

Into The Wind • **(800) 541-0314**
1408-A Pearl St., Boulder, CO 80302

ECLIPSE CRUISE 95

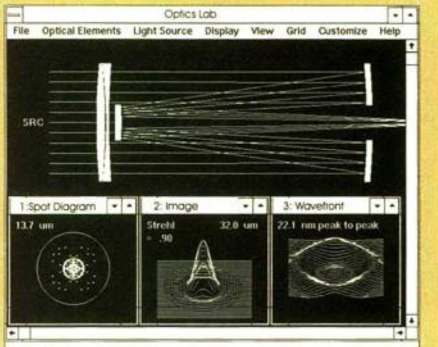
October 16-26,

ABOARD ORIENT CRUISE LINE'S

ORIENT LINES™ **MARCO POLO**

Lectures, newsletters featuring
"LAST WORD on the STARS"
FREE INFORMATION, write to:

TRAVEL STAR
7788 University Ave. • La Mesa, CA 91941
1-800-708-7677
(619) 464-1946 • FAX (619) 462-5278



NEW! Optics Lab Professional Version

Ray Tracing Software for Windows™ - $349

The new Professional version has been greatly enhanced to meet the needs of engineers and amateur astronomers.
Trace rays through Lenses, Prisms, Mirrors, Aspheres, Beam Splitters, Gratings, Oblate Ellipsoids, Toroids, Schmidt Correctors, Apertures, Cylinders, and more.
Easy to use interface - no obscure commands. Includes many automatic functions to make it easy to use.
Displays Spot Diagrams, Wavefronts, PSF, and more.
Place optics anywhere in plane and tilt in plane.
Can have 120 optics at a time (120 - 600 surfaces!).
Glass table with 300 types and room for 700 more.
Trace 6 user defined colors at once. Print graphics.
Includes many examples - Schmidt-Cassegrain, Wright, etc.
Actual screen shown above with Houghton-Cass example.
Free technical support. 30 day money back guarantee.
Requires IBM™ compatible, Win. 3.1, a 25 MHz 386DX or 486SX, 4 MBytes RAM, VGA or better, and a mouse. A coprocessor is preferred but not required with a 486.
FREE demo disk. An upgrade from Version 1 is $75.
A limited Educational version is $149. Call for details.

MASTER CARD and VISA Accepted

Science Lab Software

93 Albemarle Road
Norwood, MA 02062

617-769-5153
Fax 617-769-2158

SiberOptics

"High Tech Russian Telescopes"

6" Reflector With Equatorial
Mount and Electric Motor Drive

"Sensational Price"
$589.00
Includes: Three eyepieces
(F' = 42mm; F' = 25mm Plossl;
F' = 15mm Kellner)
3x Barlow; Reticle and 6 colored filters

Also available (Best Buy):
4.5" for $389.00 and
2.6" Starter Telescope for $139.00

For Orders & Information:
(800) 309-1236
24hr. Fax Line (202) 783-1839
SiberOptics
733 15th St. N.W., Suite 937
Washington, D.C. 20005

NOW! MORE CHOICES
•Everything Astronomical
•Terrific Bargain Prices
•Expert Personal Service

from Spectra Astro • Systems

SPECTRA PROUDLY FEATURES
THE FINE ASTRONOMY
PRODUCTS OF THESE
COMPANIES AND MANY MORE!

CELESTRON CELESTRON INTERNATIONAL
SBIG ASTRONOMICAL INSTRUMENTS
TAKAHASHI
TeleVue
TelRad Optics
LOSMANDY
1,000 OAKS
EQUATORIAL MOUNTS
DayStar Filters
PELICAN Protective Equipment Cases
Authorized Meade Dealer
JMI
FUJINON Binoculars
LUMICON
TAMRON
UNIVERSITY OPTICS, INC.

CALL, WRITE OR FAX FOR FREE CATALOG
MON-FRI 9-5 CALIF. TIME
(800) 735-1352
6631 WILBUR AVE., SUITE 30
RESEDA CA 91335
FAX 24 HRS (818) 996-7698

NEW PRODUCTS

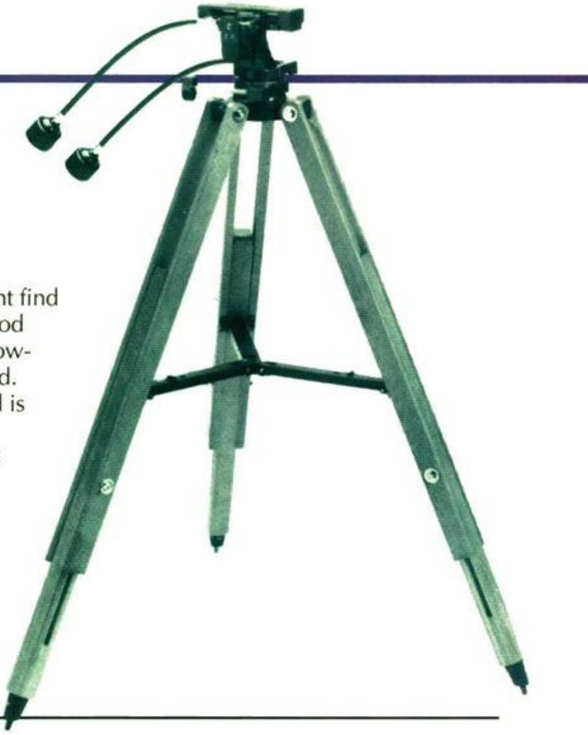
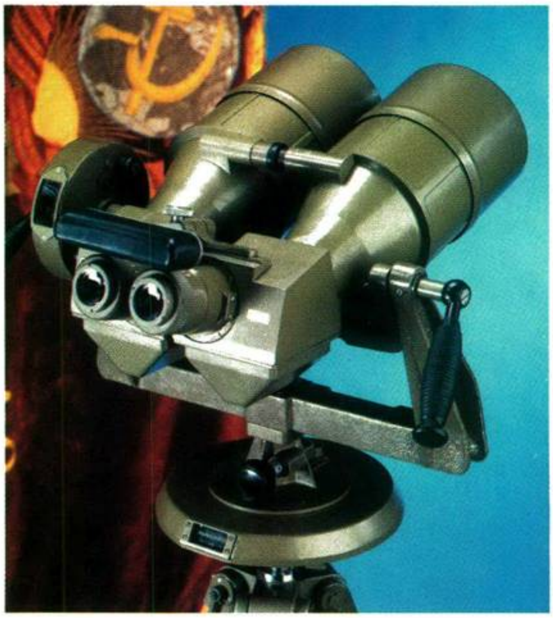


Photo Tripod

Owners of oversized cameras might find Celestron's new altazimuth photo tripod useful. It has adjustable wood legs, slow-motion cables, and a 1/4 x 20 pan head. The tripod's height with legs extended is 45 inches; legs retracted, 29 inches. Combined with the right adapters, the tripod works with spotting scopes, small telescopes, or binoculars.

Celestron, 2835 Columbia Street, Torrance, CA 90503, (310) 328-9560, fax, (310) 212-5835. Model 91533 photo tripod: $498.



Soviet Border Binoculars

These 15 x110 binoculars were made in Siberia to monitor the former Soviet Union's border frontiers. They are waterproof and have fully coated optics. The oculars are angled at 45° and focus individually down to 50 yards. Each binocular is shipped in a metal container and comes with built-in lens shades, lens covers, a tool kit, a canvas cover, English instructions, and an adjustable wooden tripod.

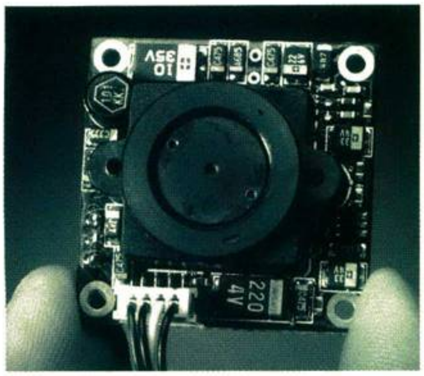
Sunset Cliffs Merchandising Corporation, P.O. Box 7518, San Diego, CA 92167, (619) 692-8196, fax (619) 692-8199. $2,500.

Catalog of Imported Optics

The Visionary Trading Company catalog presents a variety of optics imported from China and Russia. Products include roof and porro prism binoculars, spotting scopes, monoculars, night vision scopes, rifle scopes, and low-power theater glasses. The catalog offers a 4.4-inch f/7.3 Newtonian on an equatorial mount with slow-motion controls. The scope comes with four 1.25" eyepieces, three color filters, a Moon filter, and solar projection screen. Visionary also sells catadioptric telephoto camera lenses with Pentax-thread mounts.

The Visionary Trading Company, 3867 So. Valley View #20, Las Vegas, NV 89103, (800) 252-6378 or (702) 364-4600, fax (702) 364-1709. Catalog is free.

This department presents new product announcements issued by their manufacturers. Product information is as supplied by the manufacturers or distributors. All prices are suggested retail. Suppliers should send their product announcements to the attention of John Shibley.



Breadboard CCD Camera

Edmund Scientific sells a miniature CCD black-and-white camera that functions down to 0.3 lux built into a 32mm by 32mm breadboard assembly. The board is wired for 6 volt DC input and video output. The camera has an automatic shutter, and its 3.7mm pinhole lens focuses between a few inches and 15 feet. The CCD's field of view is 45° vertical and 60° horizontal and has a resolution of 380 lines (vertical) by 350 lines (horizontal).

Edmund Scientific Company, Department 15A1, C999 Edscorp Bldg. Barrington, NJ 08007-1380(609) 573-6259, fax (609) 573-6295. Item no. 52569: $195.

Waterproof Binoculars by Leica

Leica has added 8 x 50 and 10 x 50 roof prism binoculars to their Ultra line. All optical surfaces, including the roof prisms, are fully coated for maximum contrast. The binoculars' metal optical bodies are nitrogen filled and covered with shock-resistant polyurethane, making them waterproof to 16 feet underwater. The 10 x 50 BA focuses as close as 15 feet and has an exit pupil of 5 mm. The 8x50 BA focuses down to 17 feet and has a 6.25mm exit pupil. Both are center-focus, have built-in diopter corrections of ±3, and have retractable rubber eyecups. Each binocular comes with lens caps and a leather carrying bag.

Leica Camera, Inc., 156 Ludlow Ave., Northvale, NJ 07747, (201) 767-7500, fax (210) 767-8666. 8x50 BA: $1,295; 10 x 50 BA: $1,345.

METEORITES

If you own a telescope, shouldn't you have a meteorite?

For **less** than the price of an eyepiece, you can own a piece of another world!

Laboratory Authenticated Meteorites

Write, call or Fax for our educational Catalog of Meteorites.

AMERICAN EXPRESS

New England Meteoritical Services
P.O. Box 440 A, Mendon, MA 01756 USA
Tel 508 - 478 - 4020 Fax 508 - 478 - 5104

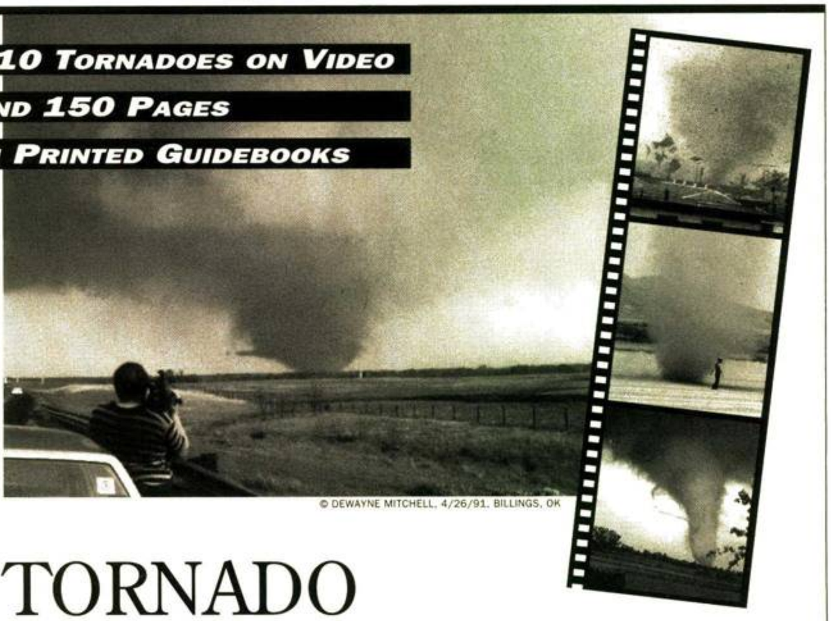
NEW!
DOB DRIVER II

Dual axis microstep quartz drive fits all Dobsonians, or user-built equatorials. Powerful computerized tracking, panning, and guiding in the palm of your hand! Super portable, super simple, AC/DC/CAR/BAT 12v. Instant setup - NO ALIGNMENT! Multi-function display. Calibration supertunes your scope to maximum performance. Options for PC link/CCD link/field-rot/DSC.

NEW SUPER-SMART SOFTWARE DOUBLES PRECISION!
Control only - $299 ATM System - $399
Complete system w/ready-to-install drives - $499
Free lit - satisfaction guaranteed!

TECH2000 3349 SR99 S
Monroeville, OH 44847
Ph. 419-465-2997 • VISA/MC • WORLDWIDE DEALERS
Pocono Mtn. Optics/PA • Broadhurst-Clarkson-Fuller/UK
Kokusai Kohki/JAP • Ultra-Vue Optics/AUS

110 TORNADOES ON VIDEO
AND 150 PAGES
IN PRINTED GUIDEBOOKS



© DEWAYNE MITCHELL, 4/26/91, BILLINGS, OK

TORNADO
VIDEO CLASSICS I & II
THE TORNADO VIDEO TEXTBOOK

TORNADO VIDEO CLASSICS I

is internationally acclaimed as the finest and most complete tornado video program in existence. It combines the 68 most famous and spectacular tornadoes with a dozen research experiments and a 3,600-word narration. You'll see merging tornadoes, tornado families, a cockpit view of rockets being fired at tornadoes, model tornadoes compared with close-ups from a helicopter, multiple vortex tornadoes, successful chases with portable Doppler radar and TOTO, telephone poles on rocket sleds to simulate tornado missiles, and more. Each scene is numbered on screen and keyed to the 50-page, 14,000-word printed guide.

Ask about our 1350 page Tornado Book and our Tornado Posters!

TORNADO VIDEO CLASSICS II

uses 42 new close-encounter tornadoes including an F-5 monster outside the living room window. A man is hit by lightning while filming a tornado, but doesn't stop until he is hit by debris from his own house. Visit the world of "Mr. Tornado," Professor T.T. Fujita, with spectacular tree-snapping, roof-flying footage in hurricanes and downbursts. The 100-page video guide is a treasury of severe storm information. It includes details on all scenes in the video and adds a 200-term glossary of severe storm and tornado spotter/chaser terminology.

Call or Write Today!

Tornado Video Classics I (2-hour video, 50-page guide)	$35
Tornado Video Classics II (2-hour video, 100-page guide)	$39
Both tapes and guides	$65
Color Poster/Funnel w. Lightning Bolt (17x22 inches)	$11

Prices include priority rate postage. Add $12 for overseas or PAL format. MC/Visa/AmEx accepted.

The Tornado Project, Box 302A, St. Johnsbury, VT 05819 or call 802 748-2505

A

One of the country's oldest telescope stores has the World's newest equipment!

Telescopes • Binoculars • Accessories
Trade-Ins • Used Equipment • Repairs

Established in 1916!

Celestron

C5⁺ Package (includes case & aluminum tripod)....................$1,500

C90 1-1/4" with camera adapter	$500
NEW! 12x80 Giant binoculars	$440
NEW! 20x80 Giant binoculars	$460

Tele Vue

Genesis-sdf	$1,850
Pronto with 2" diagonal	$800
Pronto with 1-1/4" diagonal	$715

All eyepieces and accessories in stock.

QUESTAR

We are a Questar dealer and offer discounts on the entire line of Questar telescopes and accessories.

Meade

We are a dealer of all Meade products including LX200's, the new Pictor CCD cameras, the ED APO refractors, and all eyepieces and accessories.

Miyauchi

20x100 binoculars	$2,175

Astropix (NEW Windows Version!)

Exposure guidance software	$40

F. C. Meichsner Co., Inc.
182 Lincoln Street, Boston, MA 02111
1-800-321-VIEW!
Tel: 1-800-321-8439 Fax: 617-426-0837
Accessible Boston showroom
Phone and mail orders welcome
Call for price list

Prices subject to change without notice.

PRODUCTS

Astronomical Refractors

Bausch & Lomb offers three newly designed "Rotary Power" 60mm f/12.5 refractors that incorporate a built-in eyepiece turret for magnification changes. All come equipped with an altazimuth mount, a tripod, an eyepiece tray, a 5x24 finder, a Moon filter, an erecting prism, a Barlow lens, as well as a set of 4mm, 10mm and 20mm eyepieces. Model 78-2570 (top) features a "vertical stabilizer" that provides slow motion control and greater stability in the altitude axis. Model 78-2565 (not pictured) is identical to model 78-2670 but has multi-coated optics to enhance image contrast. Model 78-2375 (bottom) comes without coatings and the vertical stabilizer. All scopes have a limited lifetime warranty.

Bausch & Lomb Sport Optics Division, 9200 Cody, Overland Park, KS 66214, (800) 423-3537. Model 78-2375: $189.95; Model 78-2470: $219.95; Model 78-2565: $299.95.

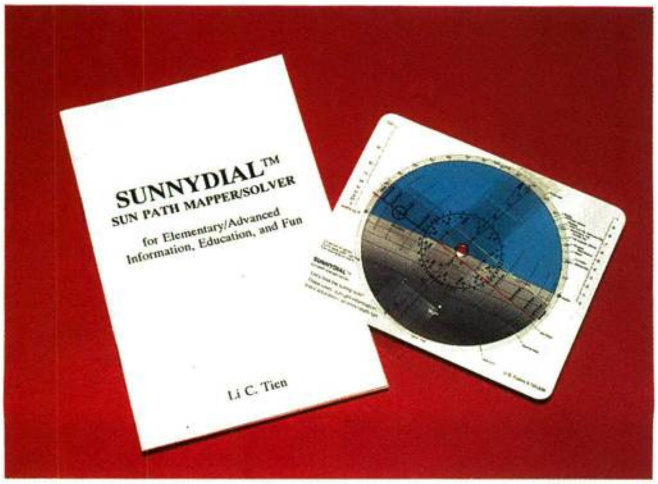
Video and CD-ROM Catalog

The Space Video and CD-ROM Library catalog offers over 50 documentary videos that cover the history of manned and unmanned spaceflight. Many videos are taken from official NASA films, and some titles focus exclusively on Soviet spaceflight. The CD-ROM section has disks that deal with Earth, the Moon, Mars, and manned spaceflight.

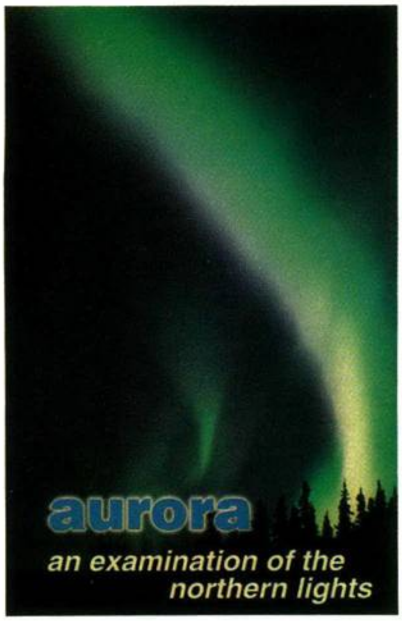
Space Video & CD-ROM Library, P.O. Box 1557, Arvada, CO 80001, (303) 673-8619, (800) 928-1757. Free.

Sun Data Dial

A series of transparent sliding scales let Sunnydial determine the rise, transit, and set times of the Sun for anywhere on Earth during any season. The dial also rotates to show the Sun's path through the sky. One scale provides information on the beginning and end of civil, nautical, and astronomical twilight. Another calculates how much solar energy (in watts per square foot) hits Earth at a time and location you select. Sunnydial includes an instruction booklet with simple projects for predicting solar motion.



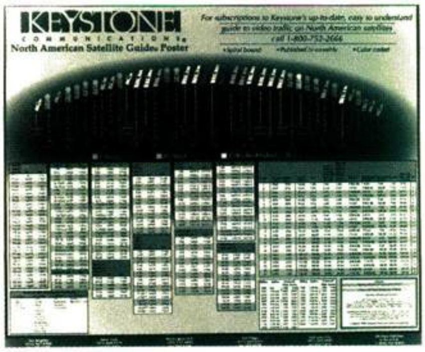
Sunny Ideas, P.O. Box 1784-File A, Midland, MI 48641-1784, (517) 832-3040. $7.



Alaska Aurora Video

Aurora, an hour-long program produced by Anchorage Public Television, explores the nature, forms, and causes of aurorae. Included is footage of northern lights shot by low-light cameras in Alaska. The video also profiles aurora research done with the space shuttle, sounding rockets and satellites, and by ground-based observers.

Graystar Productions, P.O. Box 100506, Anchorage, AK 99510-0506, (800) 330-7997. $32.95.


KEYSTONE
COMMUNICATIONS
North American Satellite Guide Poster
For subscriptions to Keystone's up-to-date, easy to understand guide to video traffic on North American satellites
call 1-800-752-2666

Communications Satellite Poster

The *North American Satellite Guide* is a 22" by 28" full color poster that provides the longitude, frequencies, and Ku-band half transponder formulas for all communications satellites that service North America. A table helps convert universal time to the user's local time.

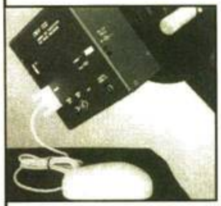
Keystone Communications, 303 East South Temple, Salt Lake City, UT 84111, (800) 752-2666. $15. ☐

ASIAN ECLIPSE 1995
October 11 - 27, 1995
Join members of the McDonald Observatory and Star Date Magazine and Radio to witness one of Nature's most spectacular phenomena, a Total Solar Eclipse. This unusual cruise program aboard the *Marco Polo* explores Southeast Asia, a region of dynamic cultural diversity. The exclusive arrangements include pre and post cruise stays in Bangkok and Singapore.
Cruise destinations include:
Singapore
Kuala Lumpur, Malaysia
Ho Chi Minh City (Saigon), Vietnam
Kota Kinabalu (Borneo), Malaysia
Cruise-only rates per person start from $2,495.
McDONALD OBSERVATORY
StarDate
Please contact:
(800) 854-4080 toll free in the U.S. or Canada.
Fax (714) 362-2075

El Paso Annular Eclipse Video

Spectacular speeded-up time-lapse shots of the Moon precisely covering the Sun from the centerline of the Annular Eclipse. Video taken from El Paso, Texas, in perfect weather. Includes unusual scenes of Hydrogen prominences disappearing slowly behind the limb of our Moon. Only $25.
Roger W. Tuthill
11 Tanglewood Lane, Mountainside, NJ 07092

New CWIP-10 CCD
Camera and Workstation for Image Processing



For PC parallel port
Single 12V Unit
Outperforms:
Film
Night scope
Video camera
8-bit CCD
Time-proven CCD design delivers 378 x 240 x 10 bits, 1000 grays
Synthetic Clock Drive shoots deep sky with non-motorized scopes
Includes interactive PC software with lossless image compression
Popular upgrades: autoguider $50, 12-bit $50, 12-bit stand-alone $550
Requires PC with VGA graphics includes power, cables and 1.25" adapter
SIRIUS INSTRUMENTS
141 N. Charles Ave
Villa Park IL 60181 USA
(708) 782-5819
$449
add $9 USA shipping

Did you miss your *SETIQuest*?
Send **NOW** for your **FREE** trial issue of *SETIQuest*, your new journal about the exciting search for evidence of life in the Universe. *SETIQuest* covers news, practical equipment/techniques, search strategies, and the observations of professional and amateur SETI investigators.
For a free sample, contact us to request Volume 1, Number 1 — be sure to include your postal address. *SETIQuest* is published quarterly, charter rate $29 per annum.
Send conventional snailmail requests to:
SETIQuest Inquiries, Dept.AS • Helmers Publishing
174 Concord Street
Peterborough, NH 03458
or, phone your request to: **(603) 924-9631**,
or, FAX your request to: **(603) 924-7408**,
or, e-mail your request to: **sqinqas@pixelacres.mv.com**
(and be sure to include your postal address)
SETIQuest™

A CLASSIC RETURNS
Enjoy the quality of a hand crafted scope by Steve Dodson for only $189.00

Sgr-3
Reflecting Telescope
• Carry it out in one hand...
Sharp wide-field sky views are only moments away.
Total weight only 7lbs.
• Exceptionally smooth steady wood mount and tripod
• 1 1/4-inch standard eyepiece gives 42 power
(substitute other standard eyepieces to get up to 125 power)
• Easy-aim "gun sight" finder
Write: Stargazer Steve, 1752 Rutherglen Cres., Sudbury, Ontario P3A 2K3, Canada Phone: (705) 566-1314

VISTA
INSTRUMENT CO.

Get the most viewing pleasure with top-rated

BINOCULAR GUIDERS

Eliminates tripod hugging, arm fatigue, unsteady viewing ★ Views from zenith to horizon, 360° in azimuth ★ Smooth action ★ Three adjustable brakes ★ Heavy construction ★ Weighs 7 lbs. ★ Mounts on standard tripod

For 60mm binoculars & under ***$140***
For 70-80mm binoculars ***$160***

BINOCULAR OBSERVING CHAIR

★ Rotates 360°, views from zenith to horizon ★ Easily adjusts to observing positions ★ Tension adjustment for binocular sizes ★ Safety wheel promotes steadiness ★ Back removes for transportation ★ Weighs 35 lbs
$350 plus UPS ship'g in USA

Bausch & Lomb
BINOCULAR

★ ***Model 11-2080.*** Finest optics & precision parts for maximum light transmission, high resolution, & peak performance. For astronomical and terrestial viewing. 20x80 center focus, porro prism, field of view 144', exit pupil 4, weight 80 oz. Sugg. retail $580.00. ***$410.00.***

Astrophotography at an affordable price!

CAMERA TRACKERS

CHOOSE FROM THREE MODELS
★ Solar and / or Sidereal tracking ★ 120 VAC, 12 VDC or dual hemisphere ★ For camera lenses up to 1000mm ★ Carries up to 7 lbs. ★ Mounts on standard tripod ★ Optional pole finderscope ★ Weighs only 9 lbs.
$300-380

VISTA DRIVE CORRECTORS
JP400 / 500 Series— ***$325-385***

★ Designed to drive Meade, Schaefer, Byers, Celestron C-14, etc., with high precision, resolution and accuracy ★ Available with options for SBIG, single or dual axis interfacing and 240 VAC, 50 Hz foreign operation ★ Synchronous and stepper systems

Other systems available from ***$125-$1500***

VISA / MASTERCARD ACCEPTED • IN USA CALL TOLL-FREE
1-800-552-9170
For free brochure call (805) 925-1240.
For full line catalog send $2.00 to VISTA INSTRUMENT CO., P.O. Box 1919-A, Santa Maria, CA 93454.

View the Hidden Surface of Venus

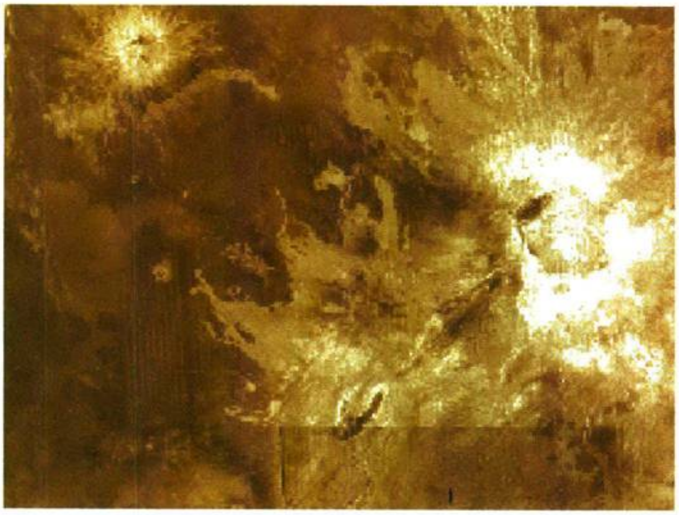
Venus Explorer
Virtual Reality, 2341 Ganador Court, San Luis Obispo, CA 93401, (805) 545-8515, fax (805) 781-2259, BBS (805) 781-2257. Price: $69.95. Minimum requirements: 80386-based computer, 4 MB of memory, DOS 3.0, VGA display (with VESA graphics modes), mouse, and CD-ROM drive. Virtual Reality recommends a SuperVGA display. A Macintosh version is also available.

With their previous release called *Mars Explorer,* Virtual Reality let the user view the surface of the Red Planet using data from the Viking Orbiter spacecraft (see AstroBytes, August 1993). Now they let armchair astronomers see through the cloud decks of Venus. Using the radar imagery of the Magellan spacecraft, *Venus Explorer* displays the craters, channels, chasms, mountains, and volcanic domes, calderas, and coronae on Earth's sister planet.

The main display shows a map of the planet from 52° north latitude to 50° south latitude. Moving the cursor in this map selects a region for detailed viewing. Four levels of resolution let the user zoom in on details. Level one shows about 13 kilometers per pixel, level two shows 6.5 km per pixel, level 3 shows 3.2 km per pixel, and the highest level shows 1.6 km per pixel. A second display mode shows the planet as a sphere that rotates at a user-controlled speed to demonstrate what the planet would look like from space if it had no clouds.

Finding a particular region on the surface is easy with Locate. Type in a feature's name or use the alphabetical list, and *Venus Explorer* brings up the proper region on the computer screen automatically at the right zoom level. The user can select to print the names of features with the size of the name corresponding to the size of the feature. The display can also include coordinate lines indicating latitude and longitude.

The display automatically shows the surface features in the yellow and orange tones that have become standard for images of Venus. Users can also choose a gray scale or a multihued false-color scheme or build their own color palette for displaying the image. Simple keyboard strokes change the image's brightness and contrast. *Venus Explorer* can save images complete with names and coordinate lines in a PCX-formatted file for use in another program.



Sky Pro (2.0)
Software Bisque, 912 Twelfth Street, Suite A, Golden, CO 80401, (800) 843-7599, fax (303) 278-0045, BBS (303) 279-9533. Price: $199 (discount to TheSky users). Minimum requirements: 80286-based computer, Windows 3.1, and a hard drive with 2 MB of free space. Software Bisque recommends at least a 256-color SVGA monitor to display images.

Software Bisque has produced a new version of *SkyPro* with many new features (see AstroBytes, January 1994, for a review of version 1). It works with all SBIG cameras, including the new ST-7 and ST-8 models, and operates SBIG color filter wheels. Image downloading from the camera to the computer is fast with the new 115K baud serial line to SBIG cameras. Image file support includes all SBIG file formats, and FITS (8-, 16-, and 32-bit data), GIF, JPEG, LNX (for Lynxx cameras), PDS, Photo CD, PICT, and TIFF formats.

The program can utilize track-and-accumulate camera modes. A new Browse command allows quick examination of images, enables the study of different processing techniques on an image, and provides a slide show of favorite pictures. *SkyPro* can link text, sound (using WAV files), and even video (using AVI files) to an image to record information about the image or to make a slide show more interesting. A blink comparator alternates between two images to look for novae, supernovae, variable stars, asteroids, and comets.

Histogram scaling for changing image brightness now works in 16- and 32-bit modes, and unsharp masking uses 16 bits to filter images. A color palette editor makes it easy to generate false-color images. An Undo (also known as the "Oops! I shouldn't have done that") command restores an image improperly processed (doesn't work with 16-bit commands). To import other images for processing, *SkyPro* supports scanners using standard TWAIN device drivers.

PC GOES/WEFAX 4.0

Software Systems Consulting, 615 S. El Camino Real, San Clemente, CA 92672, (714) 498-5784, fax (714) 498-0568. Price: $250. Minimum requirements: IBM PC-compatible computer, 640 KB of memory, color graphics, serial port, and a single-side-band shortwave receiver.

Will it stay cloudy tonight? Download weather satellite images to find out. This package includes a radio facsimile modem that links weather satellite signals received by a shortwave radio to a computer. Broadcast schedules and orbital prediction software (tracking up to 15 satellites) tell users when to record a satellite's transmission. *PC GOES/WEFAX* also has software to process the signals into an image, display maps with latitude and longitude lines, outline states or countries, decode weather bulletins, eliminate noise from GOES 7 satellite data, and convert infrared data obtained by the NOAA/TIROS satellite into temperatures. The programs can save weather maps as GIF or PCX image files.

IRAS Data on CD-ROM

The Sky Survey Atlas made from data taken by the Infrared Astronomical Satellite is available as two CD-ROM sets. The first set, released as *IRAS Sky Survey Atlas 1991*, covers ecliptic

NOW AVAILABLE
JUPITER COMET-CRASH VIDEO

Unique, historic, spectacular color video recording. Clearly shows, in real-time, large video images of multiple comet impact sites taken from Brazil with a Celestron 8 telescope over several nights. **THIRTY MINUTES OF HISTORY FOR ONLY $35. DON'T MISS IT!!!** We also sell low-cost B&W and color real-time video cameras.

For information send a large 9-by-12-inch self-addressed envelope with 4 stamps to:

Roger W. Tuthill, Inc.
11 Tanglewood Lane
Mountainside, NJ 07092

NOTICE

Please be advised that any person or company making claims that they were once affiliated with the world's largest solar filter manufacturer, Thousand Oaks Optical, and that their filters offer an identical view, is not true. The person making these claims was employed as a part-time assembler for Thousand Oaks Optical. We hereby disavow any responsibility for the **safety** and quality of their product, nor should it be construed that it's the same as ours. For the past fifteen years the product safety and reputation of glass solar filters has been achieved by the owner of Thousand Oaks Optical.

Galleria
OPTICS
FOR
LAND, SEA AND SKY™
P.O. BOX 308
HOLBROOK, NEW YORK 11741

UNITRON BRAND BINOCULARS

LONG RANGE BINOCULARS
11 x 80mm ONLY! $300.00
20 x 80mm ONLY! $325.00
CALL US AT: 516-567-2520
All prices are subject to change without prior notice.

Precision Solar Filters

Thousand Oaks Optical solar filters are recognized around the world for their quality, consistent density and even coating across the entire aperture. We specialize in solar filters only and are the largest solar filter manufacturer in the world. Filters are available to fit all brands of telescopes and binoculars. **Thousands of our filters are in use around the world. The preferred choice of telescope dealers and exclusively used by NASA aboard the Space Shuttle. Other professional users include:** ABC, CBS, NBC & CNN News, Nova, *Discovery*, *National Geographic* and most major universities and observatories throughout the world.

GLASS (Full Aperture) Type 1

Made from high quality hand select glass, machine polished and **TRIPLE COATED** with a Nickel-Chromium alloy. Mounted in a machined aluminum cell ready to attach to telescope. Solar image is yellow-orange. No secondary filtering is necessary.

Aperture	Mounted	Aperture	Unmounted
2.4"	$49.00	2.4"	$39.00
3.1"	52.00	3.1"	42.00
3.5" to 4"	59.00	3.5 to 4"	49.00
4-1/4" to 5"	74.00	4-1/4" to 5"	64.00
6"	79.00	6"	69.00
8"	95.00	8"	85.00
10"	109.00	10"	99.00
11"	119.00	11"	109.00
12.5" to 13.1"	149.00	12.5" to 13.1"	129.00
14"	169.00	14"	149.00

40mm to 80mm Binoculars - Mounted .... $92.00 pr.

GLASS (Full Aperture) Type 2

Same as type 1, except stainless steel is combined in the coating to provide an even more durable surface that highly resists wear due to excessive handling and ultraviolet radiation. Solar image is also yellow-orange.

Aperture	Mounted	Aperture	Unmounted
2.4"	$62.00	2.4"	$52.00
3.1"	65.00	3.1"	55.00
3.5" to 4"	76.00	3.5 to 4"	66.00
4-1/4" to 5"	96.00	4-1/4" to 5"	86.00
6"	105.00	6"	95.00
8"	125.00	8"	109.00
10"	139.00	10"	129.00
11"	149.00	11"	139.00
12.5" to 13.1"	179.00	12.5" to 13.1"	159.00
14"	199.00	14"	179.00

40mm to 80mm Binoculars - Mounted .... $115.00 pr.

GLASS (Full Aperture) Type 3

Coated to a neutral density of 4 for serious astrophotographers who desire the shortest possible shutter speeds with slow films. Solar image and optical quality same as type 1 & type 2. Type 3 filters are for photographic use only.

Aperture	Mounted	Aperture	Unmounted
2.4"	$79.00	2.4"	$65.00
3.1"	82.00	3.1"	69.00
3.5" to 4"	99.00	3.5 to 4"	79.00
4-1/4" to 5"	125.00	4-1/4" to 5"	110.00
6"	135.00	6"	115.00
8"	159.00	8"	139.00
10"	172.00	10"	152.00
11"	199.00	11"	179.00
12.5" to 13.1"	229.00	12.5" to 13.1"	209.00
14"	259.00	14"	239.00

Types 1 & 2 are for unlimited visual use and general photographic use. Instructions included with all filters, including tips on solar photography.

1/4 WAVE PREMIUM FILTERS

(Type 2 coating)

Aperture	Mounted	Aperture	Unmounted
2.4"	$129.00	2.4"	$119.00
3.1"	199.00	3.1"	189.00
3.5" to 4"	269.00	3.5 to 4"	259.00
5"	349.00	5"	339.00
6"	399.00	6"	389.00

Add $15.00 for Type 3 coating.

Off-axis also available for popular brands starting at 6" aperture.

Please call or write for available sizes and pricing.

5 year warranty on Type 1, 2, 3 & 1/4 wave filters.

H-ALPHA PROMINENCE FILTERS.
Priced from $699-$859 complete & ready to attach to telescope. Please call or write for additional information.

PRICE GUARANTEE: If you see a lower price on any competitive brand of glass filter, simply note the brand and we'll automatically match it. (Excludes 1/4 wave premium line.)

Our 16th year of manufacturing solar filters.
30-DAY UNCONDITIONAL MONEY-BACK GUARANTEE

ORDERING INFORMATION: Glass filters are shipped free within the continental U.S. (Please call or write for shipping cost outside of the U.S.) Payment may be made by personal check, bank check or money order. We also accept **VISA, MasterCard and American Express.** (No bank hold on personal checks.) **PLEASE SPECIFY TELESCOPE BRAND AND/OR OUTSIDE DIAMETER MEASUREMENT OF TELESCOPE TUBE.** The cost of the filter is determined by the telescope aperture. The mounting cell fits over and around the end of the telescope tube (friction fit). Unmounted filters are the glass filter without a mounting cell.

Free brochure available. Foreign inquiries: Please include $1 for return airmail postage of brochure. Proforma invoices available upon request.

TOLL-FREE ORDER LINE- U.S. & CAN.(800) 996-9111
QUESTIONS & INFORMATION: (805) 491-3642
(MON-FRI 10-5 PM PACIFIC)
FAX (805) 491-2393 (24 HOURS)

THOUSAND OAKS OPTICAL
Box 4813 Dept. A • Thousand Oaks, CA 91359

ODYSSEY
TELESCOPES
Seeing the *real* Universe

ODYSSEY 8" COMBO
2 SCOPES FOR ONE LOW PRICE!
INCLUDES: $395.00
- 8" f/4.5 RFT SCOPE
- 8" f/7 LUNAR-PLANETARY SCOPE
- FULLY ASSEMBLED DOB MOUNT W/EYEPIECE

ENJOY DUAL RANGE VIEWING!

THE ODYSSEY ADVANTAGE
- NO ASSEMBLY REQUIRED
- MOUNT MADE OF OSB — NOT PARTICLE BOARD
- 50% STRONGER TUBES
- 15 YEARS BUILDING DOBS
- LOWEST PRICES

8 INCH - f/4.5 or f/7 $295.00
"On the Moon and Jupiter, the Odyssey 8 showed as much detail as several 8" Schmidt-Cassegrains nearby."
David McGough, Millington, N.J.

"It is worth twice what I paid, but please don't raise the price. I want to get my son one in a few years."
Tom Johnston, Boulder, Colo.

10.1 INCH - $395.00
"Careful star-testing of the 10.1" Odyssey Compact I received last March and of the 10.1" my neighbor Doug Barnes picked up in mid-October suggests a high level of quality control which is astonishing. Diffraction patterns are virtually interchangeable, and both scopes show textbook optical results (both in-focus and out-of-focus)."
Lee Johnson, Coquitlam, B.C. Canada

13.1 INCH - $595.00
"In amateur astronomy for over 35 years and I have seen my share of all kinds of telescopes, good and bad. To say the least, the Odyssey 1 outperforms any thing that I have seen!!"
Richard Ziegler, Maumee, Ohio

"There is not another telescope of equal size in our club that can touch the clear image and ease of operation that Odyssey 1 provides."
Mark Davenport, Pinellas Park, Fla.

17.5 INCH - $1150.00
"I've only had a chance to view once so far, but am thoroughly thrilled with it. Viewing from a (Santa Barbara, Ca.) residential front yard, the Orion Nebula was indeed a treat – reddish tinges on the predominating green, with many subtle wisps and lanes very clear. The Andromeda Galaxy was surprisingly bright, as was its companion."
David Broad, Santa Barbara, Ca.

EASY TO ORDER...Phone or mail your order in today. Visa/MasterCard accepted. All telescopes are shipped freight charges collect. All mirrors are shipped prepaid in the contiguous U.S.A. No sales tax on out-of-state orders. Phone orders Mon.-Fri. 8 am-4:30 pm local time.

Ask for Free List
Call 1-909-659-4621
- 30 days returnable
- 30 days exchangeable
- 2 years materials and workmanship

Coulter Optical, Inc.
P.O. Box K • Idyllwild, CA 92549

"OPTIMUM OPTICS AT MINIMUM COST SINCE 1967"

VIRTUAL SKY

Looking for the *real* revolution in astronomy software? Want a virtual sky on your desk?

Are you looking for something fast, easy to use, informative, and fun?

Are you interested in viewing historical astronomical events in a realistic context?

Looking for software that delivers double stars? Variable stars? Eclipse animation?

What other software:
- Shows the sky as it really appears?
- Simulates binoculars and 3"-24" telescopes?
- Shows all the visible moons of the planets?
- Captures star fields to 16th magnitude?
- Displays double stars with orbit diagrams?
- Displays variable stars with light curves?

Only PC-Sky does all these things!

Isn't it time you gave us a call for more information?
1-800-827-8265. FAX (619) 463-6067
CapellaSoft P.O. Box 3964. La Mesa. CA 91944

ASTRONOMY CAMPS FOR ADULTS AND STUDENTS

The University of Arizona in Tucson, Arizona —***"The Astronomy Capital of the World"***— is proud to continue its award-winning astronomy camps for teenagers and adults.

Activities include:
✱ Lectures by astronomers on topics from the solar system to cosmology ✱ Viewing, photography, spectroscopy and CCD imaging of celestial objects through 40", 60" and 61" telescopes on Mount Lemmon
✱ Tour of Mirror Laboratory
✱ Application of computer and engineering technologies.

Camp Dates
Adults: April 28-30, Oct. 27-29
Teens (Basic): June 13-20
Teens (Advanced): June 24-July 1

Cost
Adults: $300
Teens: $485

To register:
Call Lisa Roubal at 1-800--232-8278
(In Arizona: 602-621-5233)

THE UNIVERSITY OF ARIZONA ALUMNI ASSOCIATION

BYTES

latitudes higher than 50° and costs $38. The second set, *IRAS Sky Survey Atlas 1994*, covers the ecliptic plane and costs $56. To order either set, contact the National Space Science Data Center, NASA/GSFC Code 633, Greenbelt, MD 20771, (301) 286-6695, fax (301) 286-1635, e-mail **request@nssdca.gsfc.nasa.gov**, or submit the Mosaic form at URL **http://nssdc.gsfc.nasa.gov/cd-rom/misc/cdrom-order.html**.

CD-ROM Sourcebook

MeteoQUEST, Inc., P.O. Box 10360, Bedford, NH 03110-0360 (603) 471-1802, fax (603) 471-1803. Price: $39.

This softcover book catalogs more than 300 CD-ROMs and CD-ROM sets containing data and images pertinent to the atmospheric, oceanic, earth, and space sciences. Each entry provides the name of a CD-ROM, its distributor, product identification number, and a description of its contents. When known, the entry also describes image file formats and computer requirements for any software included on the disk. An index provides a quick-look guide to the CD-ROMs. The *Sourcebook* doesn't list prices for any of the items, but a complete listing of CD-ROM developers enables interested parties to call for information about a given product.

Image Processing Workshop

The Center for Image Processing in Education will hold 10 workshops this summer on using image processing in the classroom. The content stresses hands-on exploration and discovery in physics, astronomy, biology, chemistry, mathematics, and earth science.

Each workshop costs $1,000 and includes five days of instruction, materials (including an image processing program and a CD-ROM containing images and exercises), lodging for six nights, and follow-up support from CIPE. Participants need to provide or rent a Macintosh computer. Continuing education and graduate credit for this course is available. The sites include Albuquerque, New Mexico; Seattle, Washington; Phoenix, Arizona (which also hosts an advanced workshop); Philadelphia, Pennsylvania; Dallas, Texas; Rochester, Minnesota; St. Louis, Missouri; Orlando, Florida; and Springfield, Massachusetts.

For more information about these workshops or about setting one up in your school district, call (602) 322-0118, or write CIPE, 5343 E. Pima Street, Suite 201, Tucson, AZ 85712. ☐

ASTRO BOOKS

A CCD Photo Atlas

Deep Space CCD Atlas: South
By John C. Vickers and Alexander Wassilieff, (Graphic Traffic Company, 1994), 150 pages, softcover, $29.25 ($30 Canada; $39.50 Europe; $45 Far East, Australia, New Zealand). Available from John C. Vickers, Back River Observatory, P. O. Box 1292, Duxbury, MA 02331.

Two years in the making, *Deep Space CCD Atlas: South* is volume two of what creator John Vickers and New Zealand collaborator Alexander Wassilieff hope is an all-inclusive image survey of objects accessible with backyard telescopes. A companion volume, *Deep Space CCD Atlas: North* ($32), published in 1993, covers 2,300 deep-sky objects down to a declination of –30°. Volume two is a compilation of well over 3,000 images taken of 1,600 objects that lie south of declination +30°. This is especially a boon to observers in the Southern Hemisphere, who finally have an extensive photo-survey of southern telescopic objects.

Both atlases show stars down to magnitude 21 and deep-sky objects down to a visual magnitude of 18. Objects are presented in order of increasing NGC number through a series of black-on-white images. Those with areas of varied brightness typically have at least two photos. Long exposures (up to 10 minutes for galaxies) reveal faint, outer detail, while short, one-minute exposures capture the brighter features.

The multiple views are labeled by the regions they show best, for example a "core" or "middle" picture. A tag next to larger "anchor" photos give such information as catalog designation (the atlas draws on 34 catalogs), magnitude, angular size, home constellation, and coordinates (2000.0). Even though 90 percent of the objects in *CCD South* are galaxies, the authors also include globular clusters, star clusters, emission nebulae, and dark nebulae.

At first glance, photo placement on each page seems haphazard, but bear in mind this is no coffee table picture

Image The Home Planet

Every day a fleet of Earth orbiting weather satellites image our planet. These images are relayed over shortwave radio and transmitted directly from the satellites. SSC makes the hardware and software that will let you connect your IBM PC compatible computer to a shortwave, or other radio, so that you can receive these images.

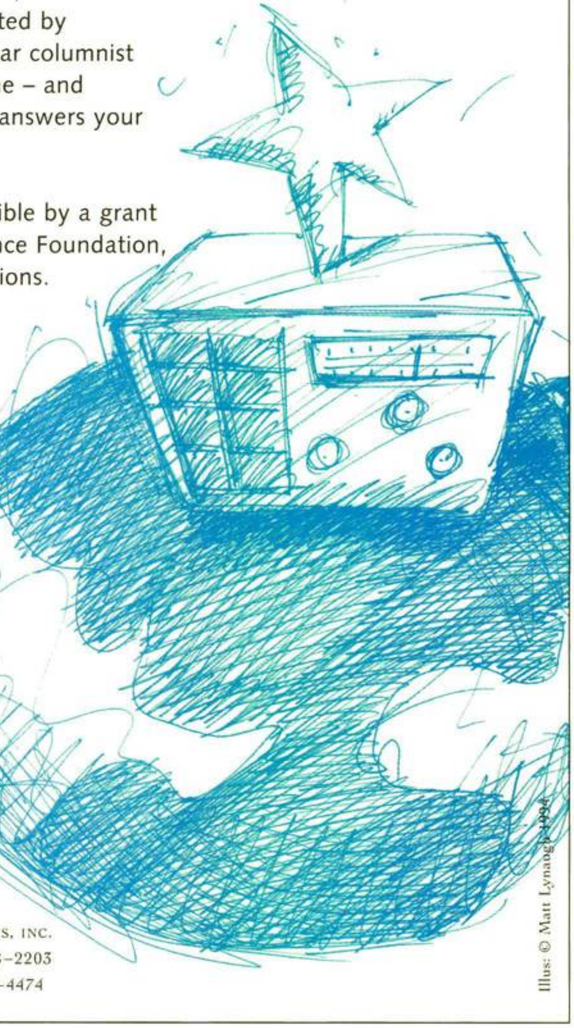
Whether you are ready to study global warming, track storms, or just see if it is worth packing off to your favorite dark sky site, SSC's weather facsimile products are for you.

At $99, our entry level system includes the radio to computer interface, software, manual and tutorial audio cassette. Software and interfaces for direct satellite reception start at $250. All packages include our image processing software with advanced features like false colorization, time lapse frame looping, zoom, scroll pan and many other features.

PC HF Facsimile $99

Complete shortwave systems including radios, antennas, software and interfaces are as little as $399. Complete systems for direct satellite reception start at $499. Call or write for our free product catalog.

Software Systems Consulting
615 S. El Camino Real, San Clemente, CA 92672
Tel: (714) 498-5784 • Fax: (714) 498-0568



Where the
Earth & Sky meet.
Every day.

Earth & Sky, the fun, informative, 2-minute daily astronomy and Earth science radio series can now be heard on more than 500 commercial and public radio stations, in all 50 states and abroad. Hosted by Deborah Byrd – a regular columnist for *Astronomy* magazine – and Joel Block, **Earth & Sky** answers your science questions.

Earth & Sky, made possible by a grant from the National Science Foundation, **is FREE** to all radio stations.

For more information, contact your local radio station or call **Earth & Sky** at (512) 480-8773.

Earth & Sky
BYRD & BLOCK COMMUNICATIONS, INC.
P.O. BOX 2203, AUSTIN TX 78768–2203
(512) 477–4441 FAX (512) 477–4474

Illus: © Matt Lynaugh 1994

TOTAL ECLIPSE 1995

Join fellow astronomers on yet another unforgettable astronomical adventure to witness the total solar eclipse of Oct. 24, 1995.

Again, we offer a choice of 3 different viewing sites - two land-based and one aboard ship.

Choose between incredible India, virtually in the shadow of the Taj Mahal or exotic Thailand with its colorful culture. Each land tour offers deluxe hotels, most meals, sightseeing, meetings with local astronomers and more.

Eclipse cruisers taking the MARCO POLO South China Sea voyage will visit Borneo, and Vietnam and Kuala Lumpur. Pre- and post-tours to Bangkok and Singapore. Expert lecturers on board.

Optional land extensions in India include other Indian cities as well as Kathmandu & Tiger Tops in Nepal. Thailand program offers optional visits to Chiang Mai and to Cambodia, Vietnam and Hong Kong. Prices from $3600 per person

STOP PRESS: Be sure to ask for information on our 1998 cruise and tours. It's not too soon to make tentative reservations!

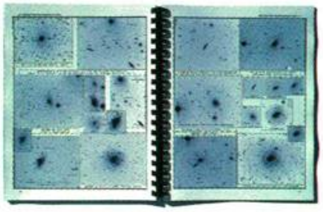
Capacity is limited, so reserve now!
Call or write for full information.

800-344-6867

Scientific Expeditions, Inc.
227 West Miami Ave., Suite #3
Venice, FL 34285

BOOKS

book. Presenting useful information is more important than aesthetics. Objects that need to be run larger are done so. If there's a slew of pictures for each object, no space on the page is wasted. Labels tell browsers where on the page to look for other images of the same object.



The pictures themselves sometimes look "posterized," or too contrasty. But this doesn't happen at the expense of detail. Observers want to know an object's distinctive shape and the relative positions of its extensions, knots and the like. Whether a picture looks "real" or not is irrelevant. Other blemishes such as the remnants of image processing or exposure flaws distract, but don't detract, from the atlas' goal of providing "ground truth" for the avid deep-sky observer.

I was initially concerned that another aspect of the atlas — being printed on heavy paper and comb bound — would affect its durability in the field, where dew has destroyed many a reference book. But with its heavy plastic cover, the atlas holds up quite well. Comb binding turns out to be extremely practical: The book folds back upon itself for easy handling at the eyepiece.

At home, *CCD South* is an indispensable deep-sky planning tool. There you browse the book to create a target list of interesting objects. In the field, you use it to compare what's really seen with your skills, type of scope, and seeing conditions. Its varied use from desk to field makes *CCD South* a worthy addition to any serious deep-sky observer's book collection. — *John Shibley*

More New Books

Discovering the Secrets of the Sun

Rudolf Kippenhahn, (John Wiley & Sons, 1994), ISBN 0-47194-160-3, hardcover, $69.95; ISBN 0-47194-363-8, 262 pages, softcover, $39.95.

By piecing together various investigative perspectives, scientists construct a complete model of the Sun's true nature. Kippenhahn surveys this process of discovery through spectrographic, visual, and radio studies. Today, novel measurements of acoustic waves even let solar astronomers plumb deep into the Sun's interior.

Secrets of the Sun not only explores what powers the Sun, but fully examines the nature of its major component: plasma (electrically charged gas). To convey a plasma's complex interaction with solar magnetic fields, the author takes us to a "plasmaland circus," where circus performers bend and twist fields analogously to phenomena we see in solar plasmas.

Though *Secrets of the Sun* tells its story in a very readable way, without the use of equations, it assumes some basic understanding of physics. A dozen or so years since high school or college introductory physics? Don't fret. With Kippenhahn's engaging explanations, it'll all come back.

Astronomy for All Ages

Philip Harrington and Edward Pascuzzi, (Globe Pequot Press, 1994), ISBN 1-56440-388-2, 160 pages, softcover, $17.95.

Astronomy for All Ages sets forth 51 projects spread across six sections that cover naked-eye astronomy, the Moon, the Sun, the solar system, deep-sky observing, and telescopes and photography.

Each project indicates a skill level and lists learning objectives and materials required. Incidental advice or facts sometimes run down the margin next to the activity text, highlighting a particular kernel of interest. Projects include making a planisphere, learning constellations, estimating star brightness, and shooting simple astrophotos. All have well-thought-out illustrations and, where needed, tables of upcoming sky events through the end of the decade.

Many activities also come with observing forms for photocopying. The end of the book provides information on astronomy books, magazines, equipment manufacturers, and the positions of the Moon and planets through the year 2000. One appendix lists items for an astronomical-theme scavenger hunt. With this book, a parent/child team or beginning stargazer would have plenty to do for at least a calendar year.

A Short History of the Universe

Joseph Silk, (W. H. Freeman and Company, 1994), ISBN 0-7167-5048-1, 246 pages, hardcover, $32.95.

A Short History of the Universe is the latest addition to the Scientific American Library of Science. In it Joseph Silk introduces the reader to the building blocks of the universe and then offers a tour of how it might have formed. Physicists today can plumb its beginning back to within the first 10^{-33} seconds, when matter itself came into existence.

But what happened a few million years or so after the Big Bang and what will ultimately become of the universe are questions still being debated today. How soon did galaxies form? Is the universe going to expand forever or collapse to form another universe? Answers to these questions depend upon the nature of matter itself, most of which lurks as yet-to-be-discovered dark matter. Its nature is being probed on varied fronts: Astronomers scrutinize distant galaxies with telescopes while physicists study subatomic particles in colliders.

Universe uses language for laypersons and many color illustrations to lay out the physics and history of today's cosmology. It's a worthy preface to the momentous discoveries undoubtedly coming in the next decade.

NASA: A History of the U.S. Civil Space Program

Roger D. Launius, (Krieger Publishing, 1994), ISBN 0-89464-878-0, 286 pages, hardcover, $16.50.

NASA's chief historian presents a concise history of NASA, from its beginnings after "the Sputnik Crisis" to present-day debates over what mandate should carry it into the next century.

The book divides into two parts: a nutshell history, or timeline, and a series of readings that focus on benchmark events in NASA's history. While part one provides a fluid time-driven narrative, part two examines in detail how certain initiatives came into being. In the timeline part of the book, Launius refers readers to certain readings when a topic is worthy of more discussion. This keeps the history section's flow unbroken, maintaining continuity without the detours of extensive explanations.

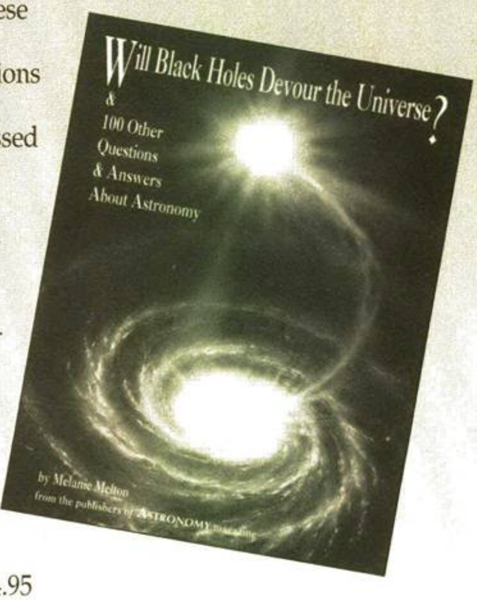
Throughout, the author successfully relates a technical history within the context of space as an extension of national policy. Political considerations drove the scientific endeavor of developing manned space flight. Consequently, the Cold War politician played as pivotal a role as the engineer. Although it lacks photos and illustrations, *NASA: A History* still manages to convey the dynamics that shaped, and continue to shape, NASA. □

Has Shoemaker-Levy left you with questions about our universe?

**Will Black Holes Devour the Universe?
& 100 Other Questions & Answers About Astronomy**

"Why do stars twinkle? Will the Sun ever burn out? What's the difference between a meteor and a meteorite?" Here astronomer Melanie Melton has collected 101 of these most-asked questions and answered them with explanations that are clear and to the point. Complex questions are addressed in simple, easy-to-understand language and, where needed, are further clarified by helpful illustrations.

Will black holes devour the universe? This charming book satisfies the curiosity within us all—and is a must-have on the shelves of educators, amateur astronomers, their families, and friends. By Melanie Melton. 7¼ x 9¾; 104 pgs.; 6+ illus.; sftbd.
#18541....................................$14.95


Will Black Holes Devour the Universe?
&
100 Other Questions & Answers About Astronomy
by Melanie Melton
from the publishers of ASTRONOMY magazine

Call toll free 24 hours a day,
1-800-533-6644.
For faster service call Monday – Friday, 8:30am – 5:00pm CT.
Please have your credit card ready. Fax (414) 796-1615.
Outside the U.S. and Canada call (414) 796-8776.

Or send your order to: Kalmbach Publishing Co., Dept. A0990, 21027 Crossroads Circle, P.O. Box 986, Waukesha, WI 53187-0986. Include for postage and handling: U.S. add $3.00 for 4th class (or $4.50 UPS in the continental U.S. only). Canada add $5.00, other foreign add $10.00. Maryland and Wisconsin residents add 5% sales tax. Virginia residents add 4.5% sales tax to total. Canadian orders add 7% GST to total. Payable in U.S. funds. Prices and availability subject to change.

Dept. A0990

ASTRONOMY'S

BLUE SKY PAGES

Welcome to the BLUE SKY PAGES section in ASTRONOMY Magazine. These pages are specifically designed to be an affordable and highly effective way for dealers to market astronomy-related products or services. Call **Colby Waller** at **800-558-1544, ext. 487** to place your advertising message here.

ARIZONA

THE ASTRONOMY SHOPPE

- Telescopes • Spotting Scopes
- Binoculars • Maps • Books
- Eye Pieces & Acces.
- "Bigfoot" Mounts
- Custom Optics

15836 N. Cave Creek Road
Phoenix, AZ 85032
602-971-3170

FLORIDA

SARASOTA CAMERA EXCHANGE & VIDEO CENTER

1055 South Tamiami Trail
Sarasota, Florida 34236

TELESCOPES
Meade APD • Celestron • Tele Vue
Large Accessory Inventory • Used Telescopes
Astrosystems Telescope Components
Astro Software • JMI Accessories

BINOCULARS
B & L • Bushnell • Celestron • Leica • Meade
Minolta • Nikon • Pentax • Steiner

Microscopes and Accessories

(813) 366-7484 Call or write Chuck, our dedicated astronomer.

TUCSON'S COMPLETE ASTRONOMY SHOP

- New and Used Equipment
- Meteorite and Meteorite Jewelry
- Books, Posters, Maps & Star-Charts
- Custom Work-Machine & Wood Shop Work Available
- Observatory Construction & Repair
- Observing site and tour guides available.
- Rental equipment available – call for details.
- Repair Work-Telescope Cleaning & Collimating
- Knowledgeable Professional Staff

Stellar-Vision & Astronomy Shop
1835 S. Alvernon #206
Tucson, AZ 85711
(602) 571-0877

Credit cards accepted. 90 days same as cash.

GEORGIA

Telescopes • Binoculars
Accessories • Spotting Scopes

Celestron • Leica • Meade
Nikon • Minolta • Pentax

Trade-Ins & Consignments Welcomed

WE SHIP ALMOST ANYWHERE

Camera Bug Ltd.
1799 Briarcliff Rd. • Atlanta, GA 30306
(404) 873-4513 • FAX (404) 873-3925
Hours: 9:00-6:00

ILLINOIS

BINOCULARS REPAIRED

ALL MAKES AND MODELS
Estimates: No cost or obligation.
Herb Koehler - Owner
Binocular Technician 43 years

TELE-OPTICS
5514 Lawrence Avenue
Chicago, IL 60630
312-283-7757

NEW HAMPSHIRE

WE BUY USED TELESCOPES

Q: Why buy from RIVERS?

A: Largest in-store display in New England!
: Full line MEADE, CELESTRON, TELE VUE, PARKS, NIKON dealer
: 30-day exchange!
: Inspection of all goods sold!
: Over 60 years in business!
: Accepts "Trade-ins"
: No sales tax!
: Best of all friendly service!

(603) 742-4888 • FAX: (603) 742-5456

Rivers CAMERA SHOP

454 CENTRAL AVENUE
DOVER, NH 03820

NEW MEXICO

NMA NEW MEXICO ASTRONOMICAL
MEADE • CELESTRON • TELE VUE
PARKS OPTICAL • UNITRON • HOME DOME

WE ARE NOW MAIL-ORDER PRIMARILY

NEW SUPER LOW PRICES!
Telescopes • Eyepieces • Mounts • Accessories
Books • Sky Atlases • Observatory Fabrication
On-Site Observatory • Regular Star Parties

INDIVIDUALIZED ADVICE FOR THE SERIOUS AMATEUR

834 N. GABALDON RD • BELEN, NM 87002
(505) 864-2953

NEW YORK

BERGER BROS
CAMERA EXCHANGE

TELESCOPES • BINOCULARS • CAMERAS • CAMCORDERS

Over 45 years in business. Honest Reputation.

BERGER BROTHERS CAMERA & VIDEO EXCHANGE
209 Broadway • Amityville, NY 11701
Info: (516) 264-4160 • **Orders:** 800-262-4160
• **Fax:** (516) 264-1007

NORTH CAROLINA

BALL PHOTO SUPPLY CO.

• Telescopes up to 14" • Spotting Scopes • Binocs – All Makes • Eyepieces, Camera Adaptors, & Accessories
• Trade-ins Accepted • Lowest Prices
• We Ship Anywhere • In-Store Repair Shop

Oldest & Largest Camera Store In The South

85 Tunnel Road
Asheville, NC 28805
(704) 252-2443 FAX (704) 253-1457

OREGON

NURNBERG SCIENTIFIC
6310 S.W. Virginia Ave.
Portland, Oregon 97201

Call Stan, our astronomy enthusiast, for expert personal assistance in choosing a fine Tele Vue, Meade or Celestron telescope and accessories.

We also carry our own full line of microscopes.

(503) 246-8297
Hours: Monday - Friday 8:30 to 4:30

ASTRONOMY'S

BLUE SKY PAGES

Your guide to local astronomical dealers

PENNSYLVANIA

AMATEUR ASTRONOMERS...

THE NEW TELE VUE - GENESIS SDF SKY TOUR PACKAGES ARE NOW AVAILABLE

SPECIAL PACKAGE INCLUDES:

Genesis SDF, Gibralter Mount, Factory Installed Sky Tour, Star Beam, Air Chair, 7 Nagler, 1.8 Barlow. PLUS Pocono exclusively also gives you a 4.8 Nagler and Thousand Oaks Solar Filter. Call or stop in for details.

- ★ **See Solar Prominences every Saturday with the Genesis SDF/Solar Kit and T-Scanner at our showroom.**
- ★ **Tele Vue Plossls sale priced from $69.00.**

Send SASE for free price list/$6.00 for complete catalog package

✵ We ship everywhere ✵

SEE OUR ADS ON PAGES 20 & 21

Pocono Mountain Optics
RR 6 Box 6329
North Pocono Village Shopping Center
Moscow, PA 18444

Orders Only (800) 569-4323
Info. (717) 842-1500 (9am-9pm)
Fax (717) 842-1408 (24 hrs.)

Showroom hrs: 10-5 Mon. – Sat.

OPTICAL GUIDANCE SYSTEMS

Custom-Made Ritchey - Chretien, Classical Cassegrain and Newtonian telescopes 10-32 inches.

World's #1 selling line of Ritchey - Chretien Scopes

2450 Huntingdon Pike
Huntingdon Valley, PA 19006
(215) 947-5571

SOUTH CAROLINA

Wonder Works

S.C. LARGEST SELECTION OF TELESCOPES:

Spotting scopes, binoculars & opera glasses
Celestron, Meade, Tele Vue & Nikon Dealers

Best prices, selection assistance, & free instruction.

PHONE ORDERS WELCOME
OPEN 7 DAYS

280 W. Coleman Blvd. • Mt. Pleasant, SC 29464
800-352-2316

WISCONSIN

EAGLE OPTICS

Meade Dobsonians & Equatorials in Stock!

Binoculars, Telescopes, Star Charts & Accessories

Shipping Nationwide

716 S. Whitney Way
Madison, WI 53711 (608) 271-4751
Toll Free Order Line (800) 289-1132

CANADA

Star Gazer Instruments

◊ Telescopes ◊ Binoculars
◊ Accessories ◊ Books
◊ Celestron, Omcon, 1000 Oaks and more!

Canada-wide delivery • (204) 476-3855
Box 1851 • Neepawa, MB CANADA R0J 1H0

CANADA

Meade APD Telescopes

CANADA-WIDE DELIVERY

Bonus Video "How To Use a Telescope" with telescope purchase ($39.95 value)

FREE! Discount Price List. Call or Write.

(416) 783-4140 FAX: (416) 783-7697

KHAN SCOPE CENTRE
3243 Dufferin Street
Toronto, Ont. CANADA M6A-2T2

1857

HARRISON

Serving Canadians for over 135 years

Telescopes, Binoculars, Microscopes, Magnifiers, Accessories, Books, Meteorological Instruments, Gadgets, T-Shirts and Sweat Shirts

• Celestron • Minolta • Meade • Bushnell •
• Bausch & Lomb • Pentax • Zeiss • Steiner •

Fast Canada-wide Delivery
Will match any advertised Canadian retail price

Montreal
Fax (514) 341-1184 • (514) 341-2079
8425 Mountain Sights Ave.
Montreal, Quebec H4P 2B9

Vancouver
(604) 737-4303
2574 Granville Street
Vancouver, B.C. V6H 3C8

The sky's the limit when you advertise in the..."Blue Sky Pages."

A regular advertising schedule in the "Blue Sky Pages" will attract attention to your business. Your store's name will be directly in front of the world's largest audience of active, affluent amateur astronomers. Call Colby Waller at 1-800-558-1544, ext. 487 for information.

Astronomy Software

High Quality, Great Prices!

SkyLights - Sky of Pittsburgh: Display
File Place Time Window Find View Arcs
Cursor
RA 7h08m47.0s
Decl +12°46'26"
Azm 143°13'31"
Alt +57°36'46"
CANIS MINOR
Galactic Equator
Betelgeuse
Bellatrix
Mintaka
Alnilam
Zoom
min
max
Panel
Lon 79°55'00" W Lat 40°26'00" N
Elev 0 m
20 Jan 1994 AD 22 10 54
UT
LT
RA 6h19m11.4s Decl 2°19'02"
Azm 170°03'02" Alt +46°48'00"
Sun Height above Horizon 53°48'17"
No Eclipse in progress
Observation Places
Place
Perth
Petropavlovsk
Philadelphia
Phoenix
Pittsburgh
Port Moresby
Prague
Praia (Cape Verde)
Quebec
Quito
☐ Daylight Saving Time
OK
Cancel
Add
Delete
Edit

☐ **SkyLights**™ Explore the Sky through Windows! For any date from 4700BC to 9999AD see Sun, Moon, planets and stars, plus all Messier objects and hundreds of selected NGC and IC objects (galaxies, clusters, etc.). Skylights is very easy to use and takes full advantage of the Windows environment, such as printer support and moveable information windows. Track an object across the sky using time steps you specify. Get detailed information by clicking on an object, such as RA & Dec., Alt & Azm, geo & heliocentric Lat & Long, rise and set & more. Database of world cities lets you pick any observing site, add your own. Database of sky events like eclipses, occultations, etc. is included, just click and observe. Has three information windows you can toggle on or off. Zoom in or out. Many controls to customize program the way you like! IBM, Windows 3.1 **$89.95**

☐ **Ceres**™ Calculates ephemeris & plots sky path for all asteroids or minor planets. Almost 6,000 included in database, with names & #'s, orbital elements, magnitudes, etc. Developed by world's authority for minor planets, the Institute of Theoretical Astronomy of the Russian Academy of Sciences. Plots asteroids against the sky using 200,000 reference stars. See orbits plotted around the Sun. IBM EGA/VGA, harddrive, 7 meg. **$159.95**

☐ **Satellite Pro**™ - Earth satellite tracking for high accuracy ephemeris & simultaneous propagations & for optical & radio tracking. Flies up to 200 satellites simultaneously. Comes with nearly 4,000 satellite orbital element sets; info for free updates. Displays Earth ground tracks, sky maps with stars, planets, Sun, Moon. Satellite RA/Dec, slant range, range rate, intersatellite range, phase angles, height, altitude & sky velocities, AOS time & pass duration. IBM VGA, harddrive **$149.95**

☐ **AstroCalc Super**™ Input time, date & lat./long. & get for Sun, Moon & planets: Right Asc./Dec., Alt/Azm, Ecliptic Lat./Long., Angular size, Fraction Illum., Elongation, Rise/Set Times, Distances from Sun & Earth, Sidereal Time, Twilight Times, Helio and Geocentric Data. Automatic repetitive calculations(solar/planetary positions or any other data for every hour or day, etc.). Output as ASCII text file or to printer. Plots of Sun, Moon & Planets on screen or laser/dot matrix printers. Helio & geocentric plots of longitude & distance or latitude & distance, RA & Dec. or altitude & azm. IBM EGA/VGA **$89.95**

☐ **AstroCalc for Windows**™ Functions similar to Super version but uses MS Windows interface. IBM **$99.95**

☐ **Gravitator Pro**™ Calculates gravitational forces on bodies like stars and planets & determines orbits. See paths plotted, vary scale of view & orientation, use 3D option. Input initial conditions or use examples provided. Save systems to run later. Display distances between bodies & forces between pairs of bodies, more! Print to dot or laser. IBM EGA/VGA, **$129.95**

☐ **StarPilot**™ Pilot your own personal starship through the universe! Explore our own real Solar System & its planets & satellites as well as 6 imaginary star systems with planets, some inhabited. Hundreds of different bodies and over 50 space stations & ground bases give you a long term high adventure! Accurate visual & flight dynamics of spaceflight developed by Ph.D. astronautical engineer. Head out to the Moon, orbit Saturn, land on Mars or go far beyond! IBM EGA/VGA **$59.95**

☐ **SunTracker Super**™ Plots solar eclipses on variable scale world maps, plus numerical data. Specify center of map & size by giving lat. & long. limits. Central line of totality is plotted & lines for north/south limits of visibility. Country boundaries & major rivers plotted. Cities can be added to maps. Output to screen or printer. IBM EGA/VGA, harddrive **$89.95**

☐ **SunTimes**™ Monthly or yearly sunrise & sunset tables for any year and location. Output to screen or printer. Twilight times, maximum altitude of Sun, azimuth of rise/set. IBM **$29.95**

☐ **MoonTimes**™ Similar to SunTimes but for the Moon. Includes rise/set times, phase & azimuth at rise/set. IBM **$29.95**

MasterCard **Order Today!** VISA

☎ **1-800-533-6666**

24 Hrs, 7 Days - FAX Orders to 412-422-9930
For Info or in PA Call 412-422-6600

Order by phone, FAX or mail. Check, M.O., or credit card (give # & exp. date). Add $4 shipping($6 outside US). In PA add 6%. Give disk size, $1 extra for 3.5". Join thousands of satisfied customers in over 120 countries. Fast shipment, friendly service.

Zephyr Services

The Leading Astronomy Software Publisher

ZS
1900 Murray Ave. Dept. B
Pittsburgh PA 15217
FREE Catalog, Call or Write

Our 14th Year

MEETINGS & EVENTS

March 31-April 1
Messier Night, Clayton, Michigan. Sponsored by Astronomical Societies of Lenawee and Hillsdale Counties. Contact Wes Boyd, (517) 547-7402.

April 1
1995 Astronomy Workshop, northeastern Kansas. Contact Brenda Culbertson, 681 Frog Hollow, Harveyville, KS 66431, (913) 589-2405.

April 1
Spring 1995 Convention, Roanoke, Virginia. Sponsored by The Roanoke Valley Astronomical Society. Contact Britt Rossie, (703) 362-1833 or the RVAS Message Line, (703) 774-5651.

April 2
Northeast Astronomy Forum & Telescope Show, Suffern, New York. Sponsored by the Rockland Astronomy Club of New York. Contact Don Urban, 73 Haring St., Closter, NJ 07624, (201) 768-6575.

April 27-29
Mid-South Star Gaze, French Camp, Mississippi. Sponsored by the Rainwater Observatory. Contact James Hill, French Camp, MS 39745, (601) 547-6865, or (601) 547-6970.

April 27-30
Peach State Star Gaze, near Jackson, Georgia. Sponsored by the Atlanta Astronomy Club. Contact Ken Poshedly, 3440 Everson Bay Ct., Snellville, GA 30278-4463, e-mail ken.poshedly@lightspeed.com.

April 28-29
NIAGfest, North Webster, Indiana. Sponsored by the Northern Indian Astronomical Groups and the Great Lakes Region Astronomical League. Contact Kurt Eberhardt, 3370 E. Kenway Dr., Warsaw, IN 46580, (219) 269-6289.

April 28-30
Delmarva Star Gaze, near Dover, Delaware. Sponsored by the Delmarva Star Gazers Amateur Astronomy Club. Contact Lyle Jones, 230 N. Bradford St., Dover, DE 19901, (302) 736-9842.

April 28-30
Southern Star Astronomical Convention, Little Switzerland, North Carolina. Sponsored by the Charlotte Amateur Astronomers Club. Contact Robert Francis, 5742 Wedgewood Dr., Charlotte, NC 28210.

April 29
Annual Meeting of the International Dark Sky Association, Tucson, Arizona. Contact Dave Crawford, Executive Director, 3545 N. Stewart Ave., Tucson, AZ 85716.

April 29
STARCONN '95, Middletown, Connecticut. Sponsored by the Astronomical Society of Greater Hartford. Contact Suzanne Marinan, P.O. Box 2271, Hartford, CT 06145-2271, (203) 242-7061.

May 6
Family Astronomy Day, Southold, New York. Sponsored by the Custer Institute Observatory. Contact Custer Institute, Main Bayview Rd., Southold, NY 11971, (516) 765-2626, e-mail starwatchr@aol.com, BBS 765-2782.

May 18-21
International Space Development Conference, Cleveland, Ohio. Contact Jim, 6167 Oakwood Circle, North Ridgeville, OH 44039-2663.

May 21-28
Texas Star Party, Fort Davis, Texas. Sponsored by the Southwest Region of the Astronomical League. Contact TSP Registrar, (915) 426-3202.

May 25-27
Astroblast 95, Franklin, Pennsylvania. Sponsored by the Oil Region Astronomical Society. Contact John O'Hara, c/o ORAS, Two Mile Park, RD #5, Franklin, PA 16323, (814) 677-3972.

May 26-28
Jersey Star Quest V, Sussex, New Jersey. Sponsored by the AAAP. Contact Larry Smith, 361 Stacy Dr., Belle Mead, NJ 08502.

May 26-29
Riverside Telescope Makers Conference, near Big Bear Lake, California. Contact RTMC, c/o Fox & Stephens, 9045 Haven Ave., Suite 109, Rancho Cucamonga, CA 91730.

June 24-25
Universe 95, College Park, Maryland. Contact the Astronomical Society of the Pacific, 390 Ashton Ave., San Francisco, CA 94112, (415) 337-1100. ☐

Clubs, please submit announcements four months before the event. Readers, include a self-addressed, legal-sized envelope with your request for information.

UNIVERSE '95

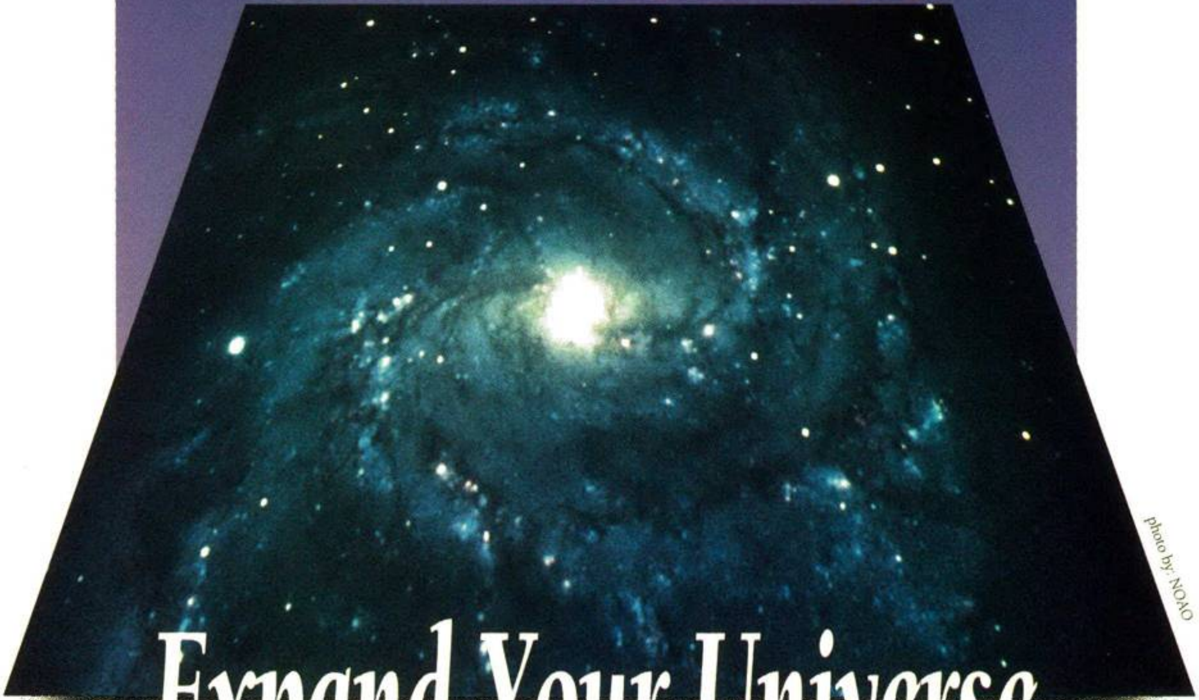


photo by: NOAO

Expand Your Universe

June 24-25, Saturday and Sunday at College Park, Maryland

Cosponsored by *Astronomy* magazine and the Astronomical Society of the Pacific, and hosted by the Department of Astronomy of the University of Maryland-College Park.

Hear special guest speakers:

Tereasa Brainerd, Laura Danly, Eric Feigelson, Heidi Hammel, Neil Gehrels, Margaret Geller, Jeff Goldstein, David Helfand, Anne Kinney, Charles Lada, Rob Landis, Stephen Maran, Lucy-Ann McFadden, Robert O'Connell, Carl Pilcher, Michael Richmond, Vera Rubin, Stephen Strom, William Waller, and many others.

Shop at the year's biggest exhibit and sale of new telescopes, accessories, CCD cameras, software, books, posters, and astronomical gifts.

Also during the 107th meeting of the Astronomical Society of the Pacific: Universe in the Classroom, a workshop for K-12 teachers, Thursday and Friday, June 22 and 23

Pre-registration advised. Contact:
Universe '95
ASP 390 Ashton Avenue
San Francisco, CA 94112
Phone (415) 337-1100 • Fax (415) 337-5205

ADORAMA INC.

42 WEST 18th STREET • NEW YORK, NY 10011

PHONE ORDERS ACCEPTED DAY OR NIGHT
- Mon–Thurs. 9 till 9:30 PM
- Fri. 9-1:45
- Sunday 9:30–6 EST

STORE HOURS:
- Mon.–Thurs. 9–7pm
- Fri to 1:45
- SUN 9:30–5:45

ORDER TOLL FREE • US & CANADA
800-7-ADORAMA
800 - 723 - 6726

ORDERS & INFO **212-647-9800**
FAX **212-463-7223**

CUSTOMER RELATIONS • 212-741-0466
• Mon–Thur. 9–4:30, Sun. 11-2 EST

COMPLETE with MANUFACTURER'S ACCESSORIES

Visit... the greatest telescope display in the Eastern United States

See... our display of the latest design in **computerized** telescope technology of Meade, Celestron, Edmund Scientific, Tele-Vue, Bushnell telescopes and a full line of accessories

Talk... to knowledgeable *telescope sales staff*, who are glad to guide you to a wise purchase.

Meade®
THE LEADER'S EDGE

We Carry The Complete Line

We are one of the largest Meade stocking dealers on the East Coast with the full line of **Meade** on display

Before you make your purchase, call us for our low prices and don't forget to visit our large display of Telescopes. There you can see all the latest wonders from **Meade**

MEADE EYEPIECES Series 4000

Super Plossl		Ultra Wide		Super Wide	
6.4,9.7,12.4,15mm	**Call**	4.7mm	**Call**	13.8mm	**Call**
20, 26mm	**Call**	6.7mm	**Call**	18mm	**Call**
32mm	**Call**	8.8mm (1.25"/2")	**Call**	24.5mm	**Call**
40mm	**Call**	14mm (1.25"/2")	**Call**	32mm (2")	**Call**
56mm (2")	**Call**	Barlow 2X Ser 4000	**Call**	40mm (2")	**Call**

Series 3000 Plossls .... **Call**

MEADE TELESCOPE ACCESSORIES

Accs. Case #50	**59.95**	#908N Nebular	**Call**
Barlow 2X 1.25" #122	**Call**	#911N Nebular	**Call**
Barlow 2X,3X 1.25 #127	**Call**	**8000 Object Library for LX200** (Version 2.5)	**49.95**
2" Star Diagonal #929	**Call**	Electric Focuser #1207	**139.95**
Off Axis Guider	**Call**	Electric Focuser 1206/1205	**139.95**
12mm Illum Reticle w/wire	**Call**	Dew Shield 8"	**103.95**
12mm Illum Reticle wireless	**Call**	Dew Shield 10"	**114.95**
9mm Illum Reticle w/wire	**Call**	Dew Shield 12"	**174.95**
9mm Illum Reticle wireless	**Call**	Piggy Bk Brkt 2080/2120	**29.95**
45° Erect .96"	**44.95**	Counterweight Syst. 8"	**84.95**
45° Erect Diag. 1.25"	**47.95**	Counterweight Syst. 10"	**89.95**
45° Erect Diag. Hybrid	**39.95**	Counterweight Syst. 12"	**94.95**
Diag. Porro Prism 1.25"	**54.95**	Tele Extender	**Call**
Photo Visual Filt Set 4 pc.	**Call**	Tele Extender Variable	**Call**
#1A Sky Filter	**44.95**	6x30 Viewfinder	**Call**
#908B Nebular Filter	**Call**	8x50 Viewfinder	**Call**
#911B Nebular Filter	**Call**		

Meade Reflectors / Refractors

4.5 Reflector. w/Equatorial Mount	**Call**
60mm Altazimuth Refractor	**Call**
60mm Equatorial Refractor	**Call**
90mm Altazimuth Refractor	**Call**
90mm Equatorial Refractor	**Call**
Basic Camera Adapter 1 1/4"	**29.95**
Variable Projection Camera Adapter 1 1/4"	**39.95**
JMI AC Motor Drive for 395/285/4500	**79.95**
Meade DC Drive for 395/285/4500	**94.95**

Celestron
5" compact scope
C5 1250 F/10 Schmidt Cassegrain with Starbright coating.
Available in 3 versions:

C5 Telescope w/AC Drive	**Call**
C5+Telescope w/DC Drive	**Call**
C5 Spotting Scope	**Call**
C5 Tripod	**239.95**
Radial Guider C5	**109.95**
DEC Motor C5	**99.95**
JMI Focus Motor C5	**99.95**
Carry Case for C5/C5+	**139.95**
Piggyback Counterpoise C5	**64.95**
Advanced Astro Master f/C5	**549.95**

Celestron Reducer/Corrector f/6.3

This combination focal reducer and field corrector lens accessory works with all Celestron and Meade Schmidt Cassegrains. Now it is possible to have a dual focal ratio instrument without sacrificing image quality. The Reducer/ Corrector is f/6.3 for C8 and C11, f/7 for C14. A four element, fully multi-coated accessory. Results are amazing BOTH visually and photographically.

114.95

New CCD AUTOGUIDERS

You can now get the latest in CCD at Adorama's renowned most competitive pricing CALL

BAUSCH & LOMB
BUSHNELL

DISCOVERER

DISCOVERER with 15-60x Zoom	**173.95**
Discoverer Case	**44.95**
Tamrac Case for Discoverer	**19.95**
Camera Mount	**12.95**
Car Window Mount	**34.95**

ELITE PC

611548PC #ELITE with Zoom E.P.	**Call**

SPACEMASTER (60mm)

Spacemaster	**147.95**
Spacemaster ED	**289.95**
Spacemaster Rubber Armored	**161.95**
Spacemaster with 15-45x, Table Tripod & Case	**243.95**
Spacemaster Rubber with 15-45x Table Tripod & Case	**254.95**

SPACEMASTER ACCESS.

15, 20, 25, 40 & 60x EP	**33.95**
22x Wide Angle	**48.95**
15-45x Zoom Eye Piece	**81.95**
Camera Mount	**29.95**

Baush & Lomb Elite 77mm

Elite Spotting Scope	**Call**
Elite ED Spotting Scope	**Call**

Tele Vue®

PLOSSL		BARLOW	
55mm 2"	**Call**	2.5X, 1.8X 1 1/4"	**Call**
40, 32mm 1 1/4"	**Call**	Big Barlow 2x 2"	**Call**
26, 21, 17, 13mm 1 1/4"	**Call**		
10.5, 7.4mm, 1 1/4"	**Call**		

PANOPTIC		NAGLER	
15mm 1 1/4"	**Call**	20mm Type 2; 2"	**Call**
27mm 1 1/4"	**Call**	16mm Type 2; 2, 1 1/4"	**Call**
22mm 1¼"	**Call**	12mm Type 2; 2, 1 1/4"	**Call**
35mm 2"	**Call**	13mm 2" & 1 1/4"	**Call**
Panoptic Barlow Interface 2"	**Call**	9mm 2" & 1 1/4"	**Call**
		7mm 1 1/4"	**Call**
		4.8mm 1 1/4"	**Call**

ACCESSORIES

2" Star Diagonal	**Call**
Rich Field Kit w/New 55 Plossl 2" S.D., Adapt, 2" to 1 1/4" Adapt	**329.95**
1¼" E.P. Adt. f/Questar	**59.95**

PARACORR COMA CORRECTORS

1 1/4"	**Call**
2"	**Call**

TELE VUE REFRACTORS

Genesis™-sdf

GENESIS SDF Fluorite-APO	**Call**
GENESIS Fluorite	**Call**
GENESIS-SDF Outfit w/Sky Tour Computer & Gibraltar Mt.	**Call**

PRONTO 70mm Aperture f/6.4 w/ED Glass

PRONTO w/2" star diagonal & 21mm Plossl	**Call**
PRONTO w/1.25" erect prism & 21mm Plossl	**Call**
PRONTO w/1.25" Star Diagonal & 21mm Plossl	**Call**

MOUNTS & ACCESSORIES FOR TELE VUE REFRACTORS
New SKY TOUR Computer–Call for details

GIBRALTAR MOUNT	**424.95**
Gibraltar Mount with Sky Tour Computer	**Call**
Starbeam ."Red Star" Projection Finder	**Call**
Piggy-Cam .Camera Adapter	**41.95**

CELESTRON TELESCOPE ACCS.

AC Adpt. C5+, C8+ Ultima	**24.95**	Piggyback Bar Assembly 11"	**64.95**
Car Bat. Adpt. C5+,C8+ Ultima	**19.95**	Polarizer Set 1 1/4"	**48.95**
Accessory Case	**49.95**	Series 6 Filter Set	**59.95**
Barlow 1¼" 2x MC New Short Tube	**49.95**	Star Diag 1.25" MC	**47.95**
Counterweight Bar Assembly 8" or 11"	**64.95**	**New** Improved 2" Mirror Star Diagonal w/1.25" Adapt.	**124.95**
Case for C8	**169.95**	**Great Polaris 8" Mount with Polaris Finder**	**749.95**
Diagonal Erect 1.25"	**41.95**	Sky Filter #2	**39.95**
Dewstar/Shade 8"	**26.95**	Adj. Tripod Rubberized	**269.95**
Focus Motor f/Ultima's	**129.95**	Camera Adapt. Tele Extender .96"	**19.95**
Dual Axis Drive SP/GP	**269.95**	Tele Extender	**24.95**
7x50 Finder Scope with Illuminator & Bracket	**149.95**	Tele Extender Deluxe	**43.95**
Quick Release f/7x50 find	**44.95**	T. Adapter f/Schmidt Cassegrains	**24.95**
LED Flashlight	**16.95**	Vibration Suppression Pads	**39.95**
LPR A **54.95** LPR B	**79.95**		
LPR for Radial Guider	**99.95**		
Piggyback Mt 8"	**34.95**		

CELESTRON MYLAR SOLAR SCREEN FILTERS (MOUNTED)

f/C11 (5" O.A.)	**119.95**	f/C90s	**64.95**	f/C5/C5+	**79.95**
f/C4.5	**69.95**	f/C90RC GPC102	**69.95**	f/C8's	**94.95**

CELESTRON 1¼" EYEPIECES

Deluxe zoom Ocular 6.5-18mm Ortho	**119.95**

ULTIMA EYEPIECES

5mm, 18mm, 1 1/4"	**Call**	7.5, 12.5mm, 1 1/4"	**Call**		
24mm, 1 1/4"	**89.95**	30mm, 1 1/4"	**92.95**	35m 1¼"	**119.95**
42m 1¼"	**109.95**				

Ultima 2X Barlow Short Tube Version .... **Call**

New PLOSSL EYEPIECES

7.5, 10, 17, 26mm, 1 1/4"	**Call**	40mm, 1 1/4"	**59.95**

Vixen Lanthanum Eyepieces LV Series

2.5mm,	**114.95**	4mm	**109.95**
5, 9, 15mm, 1.25"	**104.95**	6, 10mm	**99.95**
20, 25mm, 1.25"	**114.95**	30mm, 2"	**154.95**

CELESTRON®

The Celestron Ultima 2000

Computer Automated 8" & 11" Schmidt-Cassegrain Telescopes

New Ultima 2000 8"	**2495.00**
New Ultima 2000 11"	**3695.00**
Ultima Economy Wedge	**229.95**

SCHMIDT CASSEGRAIN TELESCOPES

CG-11 Telescope	**Call**	**G-11 Mount only**	**1599.95**
New CG-14 Telescope	**Call**		

ULTIMA 8 P.E.C. **Call**

New C8+ TELESCOPE **Call**

NEW C8+ COMPUTERIZED TELESCOPE **Call**

JMI DEC Motor C8+ / Classic 8	**74.95**
JMI Focus Motor C8+ / Classic 8	**79.95**
8" f/10 Schmidt Cassegrain Optical Tube Assembly with Star Bright Coating, 6x30 Finder, 26mm 1.25", Star Diagonal 1.25", Footlocker Case	**Call**

ADVANCED ASTRO MASTER

New Advanced Astro Master f/fork mounted C8s	**509.95**
for GP Mounts/GII	**549.95**

COMA CORRECTOR

With 1¼", 2" Eyepiece & Focus Adapter	**149.95**

RADIAL GUIDER

Allows free movement of guider while camera is fixed	**114.95**

MULTI FUNCTION FOCAL TESTER 55

Focus on & off the optical axis at 3,16,22 & 30mm Diam. in a single setup..........only	**134.95**

MICRO GUIDE EYEPIECE	**159.95**

Alt Azimuth Mount w/Slow motion Control** ....* ***279.95

REFLECTOR TELESCOPES

New **GP-200** 7.9" f/4 Reflector	**1349.95**
C4.5" Newtonian	**Call**
New **Firstscope 114** 4.5" Newtonian Telescope	**Call**
Motor Drive f/C4.5	**199.95**
Tele Extender Refractor /Newtonian	**59.95**

REFRACTOR TELESCOPES

Great Polaris C102 102mm	**Call**
New Great Polaris C102 ED	**Call**
New Premium 80 w/45 Erect Prism	**Call**
T Adapter Refractor/C4.5	**44.95**
C60 Altazimuth	**169.00**
Firstscope 60	**Call**
60mm Equatorial	**Call**
Image Erector f/60mm Ref	**9.95**

SPOTTING SCOPES

C90	**Call**	**C90 MC**	**Call**
C90MC w/1.25" Accs.	**Call**		
C90MCRC w/1.25" Accs.	**Call**		
S-80 1.25" Spot Scope	**259.95**		
S-80+ 1.25" Spotting Scope	**299.95**	f/4 Adapter for 500/5.6	**74.95**
500 f/5.6 Telephoto	**Call**	20X 60mm ED Scope........ only	**199.95**

CELESTRON C90 & SPOTTING SCOPE ACCS.

New Barlow .96, 2x M/C Short Tube	**44.95**	Polarizer Set .96	**32.95**
		Star Diagonal .96	**29.95**
7.5, 10, 17, 26 Plossl .96	**47.95**	Diag Prism 45° .96	**46.95**
9mm Ortho, .96	**34.95**	1.25" Diag Prism 45° .for C90	**39.95**
10, 18, 25, 30, 40 Klnr.96	**32.95**	Series 5 Filter Set	**49.95**
Lens Shade C90	**54.95**	Shoulder Mount	**69.95**

TELESCOPE ACCESSORIES
LUMICON FILTERS

UHC PREMIUM FILTERS		DEEP SKY PREMIUM FILTERS			
1 1/4"	**99.50**	.96"	**59.50**	1 1/4"	**79.50**
48mm f/most 2" EP	**199.95**	2"	**119.50**	48mm	**119.50**

FILTER SET 1.25" (UHC with Deep Sky) **159.50**

H-BETA				OXYGEN III	
1¼"	**99.50**	48mm	**199.50**	1¼" ...**99.50** 48mm	**199.50**

TELRAD FINDER

Finder w/Mounting Base	**39.95**	Spare Mounting Base	**7.95**
Dew Shield for Telrad	**11.95**	Pulsar Unit	**19.95**

MEADE PARABOLIC MIRRORS

6" f/8	**139.95**	8" f/6	**194.95**	10" f/4.5	**399.95**
6" f/5	**139.95**	10" f/6	**389.95**		

MEADE ELLIPTICAL FLAT SECONDARY MIRRORS

1.3"	**26.95**	1.83"	**37.95**	2.6"	**53.95**
1.52"	**35.95**	2.14"	**45.95**	3.1"	**84.95**

MEADE RACK & PINION FOCUSER

#680 2"/1.25"	**89.95**	#682 2"	**99.**

beattie **BEATTIE INTERSCREEN PLUS** (4x Brighter)

f/Nikon F, F2, F3, F4	**87.95**	f/Olympus OM1,2,3,4	**59.95**
f/Nikon FE/FE2/FM/FM2/FA	**58.95**	f/Nikon N90	**58.95**
f/Canon EOS	**59.95**	f/Nikon 8008	**58.95**

WE SHIP PROMPTLY. ALL TELESCOPES INCLUDE U.S.A. WARRANTY
No Surcharge for MasterCharge or Visa Purchases. Personal checks welcome, will ship without delay. Name must be imprinted on check, also include address, phone, and a copy of major credit card or driver's license for reference. Shipping, handling and insurance additional. 14 day money back guarantee less shipping, with packing and blank warranty card, except film and paper. We ship UPS. Some items special order. All orders are subject to acceptance and verification. Second hand dealer's license #802862. Pictures are for illustration purposes only and may not be exact. **Prices effective till March 20, 1995** **Please address all inquiries and orders to ASTRO. DEPT. #55**

ADORAMA

42 West 18th Street • New York, NY 10011

ORDER TOLL FREE **800-223-2500**

ORDERS & INFO **212-741-0052**

FAX # 212-463-7223

JIM'S MOBILE

DEC. MOTOR/NGC Computers		FOCUS MOTOR	
f/Meade LX3/5/6/MTS	**69.95**	f/Meade LX5/6	**74.95**
DSC-Max	**488.**	f/Meade LX200	**79.95**
NGC Micro Max	**439.**	**NEW MOTOR TRACK V**	
NGC Mini Max	**549.**	Motor Track V	**Call**
NGC-Max	**749.00**		

FOCUSERS

NGF-1	**209.**	NGF-2	**159.**	NGF-3	**135.**
NGF-4	**109.**	NGF-S	**279.**		

NEW 1.25" NGF FOCUSERS

NGF-1 Mini	**151.95**	NGF-2 Mini	**114.95**	NGF-S Mini	**184.95**

FOCUSERS

NGF-1	**209.**	NGF-2	**159.**	NGF-3	**135.**
NGF-4	**109.**	NGF-S	**279.**		

NEW 1.25" NGF FOCUSERS

NGF-1 Mini	**151.95**	NGF-2 Mini	**114.95**	NGF-S Mini	**184.95**

ASTRONOMY BOOKS

Books for Beginners

Astronomy for the Beginners/ Universe for Beginers by Patrick Moore	**12.95**

Binocular Observing

How to Choose a Binocular	**4.95**
Binocular Astronomy	**24.95**
Touring the Universe Through Binoculars	**29.95**
Deep Sky Objects for Binoculars	**10.95**
Exploring the Moon Through Binoculars	**14.95**
Exploring the Night Sky with Binoculars	**4.95**

Star Atlases

Sky Atlas 2000 Deluxe Edition by Wil Tirion	**39.95**
Sky Atlas 2000 Field Ed.	**21.95**
Laminated Sky Atlas 2000 Field Edition	**59.95**
Sky Catalogue 2000. Vol. 1– 2nd Ed. (paperback)	**34.95**
Sky Catalogue 2000. Vol. 2– (paperback)	**29.95**
Bright Star Atlas 2000	**9.95**
Edmund Mag 6 Star Atlas	**18.95**
Celestron Sky Map	**16.95**
Uranometria 2000 Volume 1 or Vol. 2	**39.95**
Deep-Sky Field Guide to Uranometria 2000	**49.95**

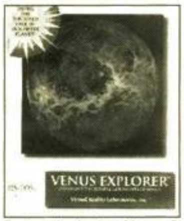
Observers' Handbooks

The Backyard Astronomer's Guide	**34.95**

1000+: The Amateur Astronomer's Field Guide to Deep-Sky Observing	**39.95**
The Universe from Your Backyard	**29.95**
The Sky: A Users Guide	**27.95**
Nightwatch by Dickinson	**19.95**
Atlas of Deep-Sky Splendors, 4th Edition	**36.95**
The Messier Album	**19.95**
Fifty Year Canon of Solar Eclipses: 1986-2035	**24.95**
Fifty Year Canon of Lunar Eclipses: 1986-2035	**19.95**
Burnham's Celestial Handbook 3 Vol. Set	**38.95**
City Astronomy	**18.95**

Astrophotography & Imaging

A Manual of Celestial Photography	**12.95**
Astrophotography II	**18.95**
Astrophotography for the Amateur	**17.95**
Choosing & Using a CCD Camera Incl. 3.5" Disks	**29.95**
Introduction to Astro. Image Processing	**29.95**



ASTRONOMY SOFTWARE

New The Venus Explorer CD ROM

only **39.95**

New The Mars Explorer CD ROM

Explore the Ancient Meteor Scarred Deserts, Windswept Chasms and Dusty Channelso of this fascinating Planet. Over 200 mb of Data **39.95**

Dance of the Planets
Standard Edition
99.95

DANCE OF THE PLANETS

New Dance of the planets QED with Observer Companion	**129.95**
Dance of the planets QED w/Observer Companion & Star 8 Extension.	**169.95**
Star 10 Extension for Dance of the Planets	**54.95**
Redshift (CD Rom)	**59.95**
Voyager II 2.0	**139.95**

SKY FOR WINDOWS
Latest Version

The Sky Windows level 2	**Call**
The Sky Windows level 3	**Call**
LX-200 Interface	**39.00**
New Sky GSC (CD ROM)	**Call**
PC Sky	**74.95**

VIRTUAL REALITY

Distant Suns (Disk)	**39.95**
Distant Suns (CD ROM)	**49.95**
Vista Pro (Disk)	**79.95**
Vista Pro (CD ROM)	**84.95**

TELESCOPE ACCESSORIES

DEW SHIELD

Collapsible, fold down easy to store and transport

for Celestron C90	**18.95**	for Meade 2045	**18.95**
f/8" Schmidt Cassegrains	**28.95**	f/10" Schmidt Cassegrains	**38.95**
f/5" Scopes	**24.95**	f/11" Scopes	**49.95**

Heavy Duty
Rechargeable DC Power Pack

12 Amp Unit	**86.95**
DC Power Inverter Converts your AC Driver to 12Volt DC	**74.95**
Voltage and Frequency Converter Converts 110V to 220V	**89.95**

EYEPIECE FILTERS 1.25"

(Not all filters available in .96" & 2")

Avail. in the following colors: 1A Skylight; 8 Yellow ;11 Yellow Green; 12 Deep Yellow; 15 Deep Yellow; 21 Orange; 23A Red; 25 Red; 47 Violet; 56 Light Green; 58 Green; 80A Light Blue; 82A Pale Blue; ND 0.3; ND 0.6

.96" & 1.25"	Ea. **11.95**
Moon Filter 1.25" (ND 9X)	**12.95**
Buy any 4 filters (1.25")	for only **39.95**
Buy any 12 filters	for only **109.95**

Special: ***4 Piece Filter Set*** includes; #12, 23A, 58 & 80A Package in a filter pouch with room for additional filters for only **39.95**

Same as above with #11, 25A, 47 & 82A **39.95**

SOLAR FILTER *by Thousand Oaks Optical*

GLASS TYPE 2 Stainless Steel Coated MOUNTED

3.1"	**64.95**	**3.5"/4"**	**75.95**	**5"**	**95.95**
6"	**104.95**	**8"**	**114.95**	**10"**	**127.95**
11"	**149.95**				

New H-Alpha Solar prominence filter w/white light Pre Filter 8" **695.**

BINOCULARS

FUJINON FMT-SX Binoculars

6x30 FMTR-SX w/Rubber Coatings & fashion strap	**319.95**
7x50 FMT-SX with Carry Case & fashion strap	**384.95**
7x50 FMTR-SX w/Rubber Coating & fashion strap	**417.95**
7x50 FMTR-CSX R.C.with Compass & fashion strap	**474.95**
8x30 FMTR-SX Rubber Coated & fashion strap	**329.95**
10x70 FMT-SX with Carry Case & fashion strap	**479.95**
16x70 FMT-SX with Carry Case & fashion strap	**519.95**
8x30 BFL w/Case	**204.95**

10x70

New Fieldscope Super 80

Super 80 with 20X-60X	**599.95**
Super 80 ED with 20X-60X	**999.95**

CELESTRON

NEW GIANT MULTI-COATED

12x80	**Call**	20x80 MC	**Call**
LPR filter set f/above.	**84.95**		

ULTIMA SERIES

7x42	**Call**	8x32 w.a.	**Call**
7x50	**Call**	10x42w.a.	**Call**
10x50	**Call**	8x56	**Call**

PRO SERIES

7x50	**Call**	New 8x40	**Call**
9x63	**Call**	10x50w.a.	**Call**
12x50w.a.	**Call**	8-24x50	**Call**

ED GLASS SERIES

6.5x44	**Call**	9.5x44	**Call**

New MINI w/Rubi Coating

8x21	**65.**	9x25	**Call**

SWIFT GIANT

20x80	**289.95**

SPOTTING SCOPES

Lynx 20x-65X	**199.95**

BINOCULAR ACCS.

Car Window Mount	**34.95**
Tripod Adapter	**16.95**

NIKON

10x70 SP w/case	**939.95**

SPOTTING SCOPES

15-45x60 Spotter R/C	**298.95**
15-45x Angle	**329.95**
New 16-47 X60 XL Waterproof 5.5	**349.95**
Photo Adapter f/SS	**19.95**

FIELDSCOPES (Body only)

Field Scope II	**239.95**
Field Scope ED II	**499.95**
Field Scope Angle	**349.95**
Field Scope Angle ED	**554.95**
New Field Scope ED 78mm	**899.95**
New F.S. ED 78mm Angle	**969.95**
15, 20, 30, 40X E.P.	@ **64.95**
60X **69.95** 30X WA	**126.95**
20-45X Zoom E.P.	**144.95**

ZEISS W/O CASE

8x56 CF GA	**894.95**
15x60 CFT GA	**1434.95**
New 15x60 "B" for Eyeglass Wearers	**1699.95**

LEICA

7x42 GEOVID	**Call**
New 10x50 BA	**Call**
New 8x50 BA	**Call**
7x42 GEOVID BDA	**Call**

New Leica Spotting Scopes

Televid 77mm Straight or Angle	**Call**
Televid 77mm ED Straight or Angle	**Call**

KOWA

SPOTTING SCOPES w/20-60x zoom

TSN-1	**569.95**	TSN-2	**549.95**
TSN-3	**974.95**	TSN-4	**949.95**

without Eypieces

TSN-1	**375.00**	TSN-2	**359.00**
TSN-3	**799.00**	TSN-4	**779.00**

NEW from Baush & Lomb NIGHT VISION Viewers

with these Night Vision aids you can see up to 200 feet in complete darkness

Night Vision Viewer Monocular	**Call**
Night Vision Viewer Binocular	**Call**

SPECIAL OFFER

Fuji Super-G 800 135-36	**5.50**
Fuji Super-G 800 36X ProPack (20)	**104.95**

Pro-Optic
Astronomical Accessories

Pro-Optic offers a unique combination of high quality with economical prices

Adorama Exclusive

Pro-Optic Plössl 1.25" Eyepieces

• Sharp detail • High contrast ghost free images • Wide 50° apparent field of view (43° on the 40mm Plössl) • 4 element optics, fully magnesium fluorite anti-reflection coating on each air to glass surface.• Lens edges are blackened to keep out reflected light • Accepts 1.25" filters.

25mm Plössl 1.25"	**39.95**		
17mm Plössl 1.25"	**39.95**		
10mm Plössl 1.25"	**39.95**	7.5mm Plössl 1.25"	**39.95**
40mm Plössl 1.25" (Field of View 43°)			only **54.95**

BUY ONE EYEPIECE AND GET THE SECOND ONE (of equal value) AT HALF PRICE!

Pro Optic 500mm f/5.6 Maksutov Telephoto/Spotting Scope

With high-tech white finish

Carry Case
Nikon
Pro-Optic

Multi-coated to maximize contrast and sharpness and a built-in field flattener to reduce field curvature.
With its 500mm focal length, it is long enough for close-ups of far away objects but with the f/5.6 optics it is fast enough to be hand held, focuses as close as 5 feet.
With the addition of the 'SS500 Kit you can convert it to a 20X 90mm spotting scope. The SS500 kit includes a 45° 1.25" Erect Image Diagonal and a 25mm 1.25" Plossl

Pro-Optic 500mm f/5.6 lens	**249.95**
Pro-Optic SS500 Kit (when purchased w/500/5.6)	**49.95**
350mm f/4 Converter for 500/5.6	**74.95**

New CELESTRON

1000mm f/10 Telephoto - Can also be converted to a spotting scope with the addition of the SS 500 Kit **Only 299.95**

Pro-Optic Slow Motion Control

With the Slow Motion control attached between your Lens/Spotting Scope and your photographic tripod, you can make accurate slow motion adjustments in altitude and Azimuth in addition the Pro-Optic SMC allows you to make major adjustments in elevation with a separate control knob. The Slow Motion Control fits any tripod with 1/4-20 thread.

Pro-Optic Slow Motion Control **39⁹⁵**

Pro-Optic 45º Erect Image Diagonal

Provides an ideal 45° angle for erect image terrestrial viewing

Pro-Optic 45° Erect 1.25"	**42.95**
Pro-Optic 45° Erect Hybrid (1.25" to .96")	**39.95**
Pro-Optic 90° Star Diagonal 1.25"	**34.95**

Attache Style

Pro-Optic

Deluxe Aluminum Eyepiece Case 14⅛ x 11⅜ x 5⅜"	**$49⁹⁵**
Deluxe Large Case 18" x 13" x6"	**$59⁹⁵**

SEE OPPOSITE PAGE FOR ORDERING INSTRUCTIONS

ASTRONOMY Reader's Exchange

Discover buyers and sellers for your astronomy products and services the cost-effective way. Place your classified ad in the ASTRONOMY Reader's Exchange!

For sale: 60mm refractor telescope with accessories, used very little; $125. Contact Steve Seller, 215 East Grange, Greenfield, WI 53142

Wanted: Beginner to intermediate telescope. Also interested in accessories. Contact Mike Beyer, 1515 Starlight Drive, Iowa City, Iowa 52244

There's no better place to reach the most active astronomy audience!

Call
1-800-558-1544,
ext. 538 to place your ad today.

ASTRONOMY®

RESOURCES & PHOTOFACTS

Descent into Darkness (page 66)

Chasing the Shadow, by Joel Harris and Rich Talcott (Kalmbach Books, 1994). Explores the history of eclipse chasing and provides a planning guide for seeing eclipses through the year 2020.

Glows, Bands (page 76)

The Aurora Watcher's Handbook, by Neil Davis, (University of Alaska Press, 1992). Full of beautiful aurora photographs and explanations.

Cover: Hal Jandorf; **p. 4:** Huguette Guertin; **top right:** John Flinn; **bottom:** Jack Newton; **p. 6:** Dan Schechter; **p. 16:** Jeffrey R. Schroeder; **p. 61:** Darryl Mason, 8-inch f/10 SCT, Ektar 100, June 14, 1992; **p. 63:** Charles Capen, July 27, 1966; **p. 64:** Mark R. Logan, 4-inch f/8.8 refractor, ISO 100, 1/60-sec. exp., May 10, 1994; **p. 65, upper left:** Kim Zussman, 11-inch f/10 SCT, hypered Tech Pan, 140-min. exp., April 8, 1989; **upper right:** David Healy, 14-inch SCT at f/11, hypered Tech Pan, 40-min. exp., April 28, 1992; **lower left:** Kim Zussman, 14.5-inch f/8 Cassegrain, hypered Tech Pan, 90-min. exp., April 13, 1991; **lower right:** Dale E. Mais, 14-inch f/7 SCT, hypered Tech Pan, 120-min. exp., April 10, 1993; **p. 66, top:** Hal Jandorf; **bottom:** Nelson B. Arnstein, 7.5mm lens at f/5.6, Kodak Gold 200, 1/4-sec. exp. from Neuland, Paraguay; **pp. 66-67, top:** Hal Jandorf, 94mm f/7 refractor, Fuji Provia 100, 1/2-sec. exp., from Iguaçu Falls, Brazil; **p. 67, bottom:** A.W. Steinbrecher, 70mm refractor at f/13, Fuji Provia, from northern Chile; **pp. 68-69:** Ernie Piini, 80mm f/8 refractor, Fuji Provia, 2-sec. exp. from Sevaruyo, Bolivia; **p. 68, bottom:** Michael Maunder, 65mm lens at f/5.6, Fuji Velvia 50, 3-sec. exp. from Parinacota, Chile; **p. 69, top:** Nelson Falsarella, from Chapecó, Brazil; **bottom left:** Paul Moeller, 5.6-inch f/7 refractor, Fuji Reala 100, 1/1000-sec. exp. taken near Arica, Chile; **bottom right:** Deborah K. Smith, from Bolivia; **p. 70:** Jack Newton, 25-inch f/5 reflector, ST-6 CCD camera; **p. 71:** Tony and Daphne Hallas, 12.5-inch f/7 reflector, Fuji Super HG 400, composite of two 45-min. exp.; **p. 72, top:** Jack Newton, 25-inch f/5 reflector, ST-6 CCD camera; **p. 72, bottom:** Dave Young, 18-inch f/4.5 reflector, hypersensitized Tech Pan, 30-min. exp.; **p. 73, top left, top right, and bottom:** Jack Newton, 25-inch f/5 reflector, ST-6 CCD camera; **p. 74, top left:** Jack Newton, 25-inch f/5 reflector, ST-6 CCD camera; **top right:** Andrew Peters, 20-inch f/5 reflector, hypersensitized Ektar 100, 90-min. exp.; **bottom:** Jack Newton, 25-inch f/5 reflector, ST-6 CCD camera; **p. 75, top:** Bill and Sally Fletcher, 16-inch f/4.5 reflector, hypersensitized Tech Pan, tricolor composite from 65-min. red, 90-min. blue, and 125-min. green exp.; **bottom:** Keith Snyder, Steve Messner, Bob Elliott, and Paul Nelson, 12-inch reflector, STAR-I CCD camera, 160-sec. exp.; **p. 76, left:** Claude Marcotte, Fuji Super HG 400, 28mm lens @ f/2.8, 5-sec. exp., November 8, 1991; **right:** Jay Brausch, Kodacolor 200, 50mm lens, 20-sec. exp., July 9, 1991; **p. 77:** John Flinn, Kodachrome 200, 20mm lens, 18-sec. exp.; **p. 78:** Russ Sampson, Fuji 1600D pulled to ISO 800, 35mm lens @ f/2, 5-min. exp.; **p. 79, top and bottom:** Jay Brausch, Kodacolor 200, 50mm lens, 20-sec. exp.; **p. 80, top:** Jim Baumgarten, Kodacolor 200, 50mm lens @ f/2, 10-sec. exp., November 8, 1991; **bottom:** Tom Polakis, Kodacolor Gold 400, 28mm lens @ f/2.8, 30-sec. exp., March 13, 1989; **p. 78:** Russ Sampson, Fujichrome 1600, 35mm lens @ f/2, 8-sec. exp.; **p. 109:** Alan Dyer, 28mm lens at f/2, Ektachrome 1600, 23-min. exp., the 40-inch telescope, Las Campanas, Chile; **p. 110, top:** George Greaney, 6-inch f/7 refractor, Fuji Super HG 400, composite of two 60-min. exp.; **bottom left:** Gerald Rhemann, 10-inch Schmidt camera, hypersensitized Tech Pan, 7-min. exp., December 3, 1994; **bottom right:** Karl Brandl, double exp. showing stars and Sun's path on July 2, 1994, made with a 30mm f/3.5 fisheye lens, Fuji Velvia, 60-min. exp. to show stars and filtered exp. of Sun's path; **p. 111, top:** Jack Newton, 25-inch f/5 reflector, ST-6 CCD camera; **bottom left:** Stéphane Dumont, 9-inch f/12 SCT, ST-6 CCD camera, composite of ten 30-sec. exp.; **bottom right:** Ken Blankenship and Dennis Batis, 14-inch f/11 SCT, hypersensitized Kodak Royal 400, 5-min. exp. using a Lumicon Skyfilter; **p. 112, top:** Robert B. Slobins, 160mm lens at f/4, Fuji NHG 160 pushed to ISO 640, shot with diffraction grating to produce a flash spectrum of the Sun; **bottom:** Olivier de Goursac, 16mm fisheye lens, Fuji Sensia 100, 2-hour exp., September 3, 1994; **p. 113, top left:** Ronald E. Royer; **top right:** Dennis L. Mammana, 70mm lens at f/8, Fuji Velvia 50, 4-sec. exp., October 7, 1994; **bottom:** John McNeal, 28mm lens at f/4, Fuji 100, 15-min. exp., September 17, 1994; **p. 114:** Erich Karkoschka, 50mm lens at f/1.8, Agfa ISO 100, 20-min. exp., October 5, 1993. □

ASTRONOMY'S CLASSIFIEDS

This section is open to anyone who wants to sell or buy astronomy-related merchandise. **RATES:** $1.25 per word. Mininum charge is $12.50. Prepayment required. All copy is set in standard typography. We do not furnish box numbers. **CLOSING DATE:** 5th of the month three months before the cover date (i.e., March 5th for the June issue). Send your ads to Astronomy, Classifieds, 21027 Crossroads Circle, PO Box 1612, Waukesha, WI 53187. 1-800-558-1544 ext. 538. MasterCard-VISA-AmerExpress.

Astrophotography Equipment For Sale

Like-new field model Questar with pyrex mirror; $800. Questar modified Nikon F camera body with FTN meter, adapter ring, type B view finder; $300. 55mm Nikon camera lens, $100. Contact Bernie Crampton, 230 Lyn Circle, Palm Springs, CA 92262, (619) 320-1281.

Complete Astrophotography package that includes Meade 2080 MCOG, diagonal, 25mm eyepeice, 6x30 finder, wedge, tripod with azimuth control, case, all literature, Losmandy accessory mount with 80 mm rings, Orion counterweight system, JMI dec. motor, Meade 12.5 mm double cross hair illuminated reticle guiding eyepiece, Vogel Digitrak II quartz drive corrector, with hand controller, Orion telescope cover, metal accessory case with lock, exposure time, full set of Allen wrenches, Meade piggyback camera mount, Spectra Sure Sharp Focuser (still in box), Meda off-axis guider, and four astrophotography books. Contact Howard Maxson, Rt. 1, Box 183-A Alcove Road, Hannacroix, NY 12087, (518) 731-6751.

Meade LX 200 10" f/6.3 with superwedge, tripod, case, expanded library, all posible photographic accessories, and in abolutely new condition; $3,000 Contact Tom, 28 Lake Drive, Livingston, MT 59047, (800) 497-1001 days, or (406) 222-4702 evenings.

Astrophotography Equipment Wanted

Camera and attachments for Tasco 3" refractor telescope. Contact Mike Gilmore at HCR Box 248, Dixon, MO 65459.

Binoculars For Sale

Orion stereo binocular viewer for 1.25" eyepiece with adaptors and two matching Orion 18mm multi-coated Orthoscopic oculars; $450. Blue waterproof nylon telescope cover for 8" SCT; $15. Lumicon Cassegrain off-axis Easy Guider; $120 or best offer. Contact Walt Farmer, (307) 733-2173.

Parks 20x80 binoculars (purchased in 1992). Excellent condition; $275 or best offer. Contact Dave Adams, (810) 795-9344.

Zeiss 7x50 binoculars with leather case. Mint condition; $400. Contact George Kohl, 4840 E. Sunnyside Drive, Scottsdale, AZ 85254, (602) 494-0879.

Books and Periodicals For Sale

Astrophotography for the Amateur, by Michael Covington; $9.95. *Stars;* $5.95. *Skyguide: A Field Guide to the Heavens;* $8.95. Please add $1 for shipping. Contact Bruce Moseley, 118 Sourdough Ridge Road, Bozeman, MT 59715.

Astronomy (Jan. 1986 to Dec. 1994), *Popular Photography* (April 1989 to present), *Petersen's Photographic* (Nov. 1989 to present), *Ad Astra* (Jan. 1989 to presen), *Final Frontier* (Vol. 1 to present), and Planetary Report (1986 to present). Young man needs help with college expenses. Contact Tom Dougherty, P.O. Box 724, Randolph, MA 02368, (617) 986-0932 or (617) 451-4100.

***Mars* by Percival Lowell;** $350. Contact Peter Wlasuk (813) 598-4444, days or (813) 597-5088, evenings.

Astronomy and Sky and Telescope; (1991 to the present); $90. Contact Michael J. "Theresa" Hutchinson, 1121 Sumac St., Longmont, CO 80501-3134, (303) 776-5322, TDD only, evenings.

Astronomy (1979-1993), several years of *Science,* and other publications related to science; $250 plus shipping takes all. Contact Dorothy, (815) 395-8021.

Astronomy (April 1985 to present), all in excellent condition; $75 plus shipping or best offer. Contact John Sevores, 2040 Chickadee Drive, Missoula, MT 59802, (406) 542-1174.

Books and Periodicals Wanted

Complete, 20-volume set of Time-Life's *Voyage Through the Universe* in perfect condition; $300. Contact Wayne at (310)-809-0719.

Books written in the late 1940s to mid 1950s by Will Ley and Wernher vonBraun and illustrated by Chestley Bonestell. Some titles include *Conqeust of Space* (1949), *Conquest of the Moon* (1952), *Exploration of Mars* (156), and *Beyond the Solar System* (1964). Also interested in children's books about space exploration written by Ley and illustrated by Bonestell. Contact Rick Blackburn, P.O. Box 13712, Los Angeles, CA 90013-0712, (213) 628-9864 or e-mail PwrPack@aol.com.

Involved in outreach to astronomy clubs in Algeria. Badly need astronomy books (classics, and modern ones on cosmology, stellar physics, etc.) and demo material to assist new generation of Algerians learning English, instead of French, as a second language. Will acknowledge all sendings. Contact Dr. Jamal Mimouni, Cite du 20 Aout, BP 145, Constantine, Algeria.

Information, publications, journals, texts, photographs, any old/new information on Thomas William Backhouse, F.R.A.S., F.R.M.S. (1842-1920), to be used for personal research purposes. Will buy any publications offered. Contact Don Simpson, 78 Stratford Avenue, Grangetown, Sunderland, SR2 8RZ, ENGLAND, U.K. Phone 091-5676-0151.

Complete collection of *Telescope Making* magazine. Contact Mark Marks, 25 Birch Lane, Palm Harbor, FL 34683, (813) 787-0498.

CCD Equipment For Sale

SBIG ST4 CCD auto guider and imaging camera. Comes complete with CCD, CCDTRACK, CCDDUTIL, AND CCDBLINK software and documentation for the PC and CCD software for the MacIntosh; $700 plus shipping. Contact John Hoot, (714) 498-5784, days or (714) 498-5765, evenings.

Communications Wanted

Communication with lunar observers who desire better live video observations (not CCD) and recordings of lunar surface. Contact Francis Ridge, 618 Davis Drive, Mt. Vernon, IN 47620, (812) 838-9843.

Miscellaneous For Sale

Press kits from unmanned missions and videos from Voyager 2, the shuttle missions, NASA Select, and the Hubble repair. Contact Becky Meadows, 1439 Providence Avenue, Springfield, OH 45503, (513) 399-2347.

Rocket kits, out of production (unopened) model and high powered rocket kits. Pre-Damon Estes kits especially desired. Also interested in *Estes Model Rocket News, Estes Educator News, Estes Spectra, Centuri American Rocketeer, The Model Rocketeer Magazine,* and other related periodic. Also looking for Jetex, Central Rocket Company, Centuri, Enerjet, Advanced Model Rocket Systems/ Space Age Industries, Roto-Rocket Company, Kopter Rotor Recovery Rockets, Coaster Corporation, Rocket Development Corporation, Model Products Corporation, Aerospace Vehicles Incorporated, Model Rocket Industries, Competition Model Rockets, Cox, Canaroc, Vashon, Ace, Pine Cap, Loc/Precision and North Coast Rocketry line of kits, catalogs, parts and motors. Send list, description, condition and price to Danny Sagstetter, 4432 N. Fourth Street, Columbus, OH 43224, (614) 268-3247.

High quality mineral collection of 100 specimens. Current value is $2,000. Will exchange for CCD system, good 8" Meade or Celestron or sell for $1,250. Contact Dr. M.G. Weller, Pendeen, Cornwall, TR19 7EL, England.

Organization Announcements

The Society for Amateur Scientists, a nonprofit organization of amateur and professional scientists, including Nobel Prize winners, dedicated to empowering people to make their own discoveries. You don't need a college degree or research experience to join, only a passion for science and a willingness to learn. Support for your own research and cutting-edge projects are now underway in astronomy and other fields. Contact us at (800) 873-8767.

Open-minded people interested in joining a worldwide group of intellectuals who communicate through the mail about cosmology and the present universe. All levels accepted. To join, send $2 (to offset costs) plus address to Michael Manning, 135 Mayhew Drive, South Orange, NJ 07079. Allow a few weeks for response.

Telescopes For Sale

C-5 spotter scope, 5x24 finder, 90° diagonal prism, 30mm Celestron Ultima eyepiece and 2x Ultima Barlow, and Ultra Heavy Duty Bogen tripod with XL pan head; $995 (mint condition). Contact David Clemens, 251 Perkiomen Avenue, Schwenksville, PA 19473, (610) 287-7716.

Astro Physics APO 6" f/8 optical tube assembly, 2.4" focuser, 1.2" reducer, 2" reducer, 7" hex rings, and blue carrying case; $1,600 plus shipping (all in very good condition). Contact Terri White, (708) 924-5190 after 7:00pm CST.

Tele Vue Pronto with 2" diagonal, 15mm and 32mm wide fields, 10.5mm and 21mm Plössls, and a 1.8x Barlow; $800 or best offer. Contact Chuck, (206) 712-9302, evenings.

New Meade 7" refractor tube assembly in excellent condition, has sharp optics and includes a 2" star diagonal; $2,700. Contact Bob Gunnerson, (303) 620-1389 or (303) 669-2191.

Tasco Newtonian 4-1/2" telescope with equatorial mount, tripod, two eyepieces, and a 2x Barlow; $350. Meade 293 60mm refractor with equatorial mount, tripod, four eyepieces, and a 3x Barlow; $250. Meade 227; $100. Contact Rosa, (619) 366-2624.

Research-grade 18" reflector; $3,500. Financing available. Call Peter Wlasuk, (813) 598-4444 days, or (813) 597-5088 evenings.

Celestron Powerstar C8 with PEC in perfect condition. Has wedge, tripod, dec. motor, owner's manual, tool kit, and extra hand controller. Has 30mm, 25mm, 18mm, 9mm, and 4mm eyepieces, and color, skylight, solar, and skyglow filters. Also includes T-adapter, T-rings for Olympus SLR, variable tele-extender, star diagonal, and erect image diagonal; $2,600. Contact Wayne at (310)-809-0719.

Meade 8" LX200 3.2 telescope (eight months old) with two eyepieces, 26mm Super Plossl, and 9mm Naglar; $1,995 (must sell). Contact Rick, (414) 982-4500.

Tasco Model 59T 525-power refractor never used, 700mm focal length, 5x4mm finderscope, rack and pinion focusing, eyepieces (SR 4mm & H 12.5mm), 3x Barlow lens, 1.5x erecting eyepiece, diagonal prism, and adjustable metal tripod with accessory tray; $100 firm, plus shipping. Contact Loren G. House, RR 1, Box 195, West Winfield, NY 13491, (315) 822-5843.

Telescopes Wanted

Meade 8" LX200 in perfect condition (six months old); $1,950. I'll pay shipping. Contact Bob Gillard, 2117 Legacy Drive, Plano, TX 75023, (214) 517-2828 or (214) 618-1686.

Meade 8" LX200 f/6.3 SCT. Includes all original equipment as well as Meade dew shield and equatorial wedge; $1,695 (seven months old and in factory new condition). Contact John Johnson, Sacramento CA. (916)648-8367 days, or (916) 722-8035 evenings.

Meade 8" LX200 SCT with dew shield, 2" diagonal, 56mm and 26mm Super Plössls, 8.8mm Ultra Wide Angle, 9.5mm Plössl, dust seal, vari-polarizer, rear cell broad-narrowband filters, vari-telextender, and radial guider with pulsed xy Super Plössl wedge; $3,100 plus shipping. Contact Michael Francioli, (716) 695-6995.

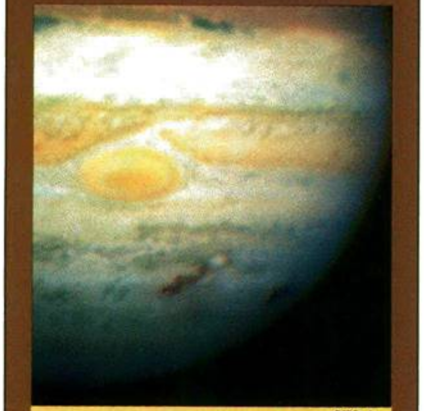
Meade 660 Newtonian scope with tripod, equatorial mount, 8x50 finder, Polaris finder, solar filter, two Meade Series 4000 eyepieces, MA 25mm and Celestron nebula filter; asking $600. Will deliver within 150 miles of Dallas and Forth Worth, Texas. Contact Thomas, (214) 579-0947

Quantum 6 with oak cases; $3,000. Byers 58 mount with electric drives and pier; $1,200. Brandon and Televue eyepieces; $50-175. Astro-Physics 52-inch oak tripod; $300. Contact Dan Fong, 11154 Pit River Court, Rancho Cordova, CA 95670.

Celestron Super Polaris C8 Starbright, motor drive with sky sensor, 8x50 finder, 26mm and 35mm Plössls, 2x Barlow, *Sky Atlas 2000.0,* all in new condition; $1,000. Contact Larry Whetzel, 15621 Calistoga Drive, Ramona, CA 92065, (619) 788-1787.

Tele Vue 40mm wide field eyepiece; $275. Contact Barry, (718) 885-2212.

COMING IN THE MAY 1995 ISSUE OF ASTRONOMY



STScI

MAKING SENSE OF SHOEMAKER-LEVY 9

Okay, what *really* happened when the comet smashed into Jupiter last summer?

GREAT SUMMER DEEP-SKY OBJECTS

A modest scope will show you bustling stellar nurseries, young and old star clusters, and aged planetary nebulae.

THE GALACTIC METROPOLIS

Take a tour through the gas, dust, and stars of the spiral arms to a possible massive black hole in the core of our Galaxy.

FAST SLIDE FILMS

Our tests show a clear winner among films that record the night sky in the shortest time.

AVAILABLE ON YOUR NEWSSTAND

APRIL 11

ADVERTISER INDEX

Adorama 102, 103
Advantage Travel & Tours 85
Astronomical Adventures 86
Astronomics 13
Astronomy Shoppe 98
AstroSystems, Inc. 85
Ball Photo Supply 98
Berger Brothers 98
Bethany Sciences 86
Black Forest Observatory 12
Bobel, Steve 87
Burbank Telescope 85
California Telescope co 29
Camera Bug 98
Capellasoft 94
CBH Travel 84
Celestron International ....17, 33, ...114
Central Camera Co 86
Cottenangora Trading Co 85
Custom Opthalmics 85
Coulter Optical Inc 94
Dallas Remote System 86
Dorrance Publishing Co 85
Eagle Optics 99
Earth & Sky Radio Series 95
Edmund Scientific Company 18
Environmental Films 89
FC Meichsner Company 90
Focus Camera 46, 47
Fujinon 29
Gateway Telescope 84
Geppetto & Son 85
Robert A Haag-Meteorites 84
Ed Hamilton, Bookseller 86
Helmer Publishing 91
Hillside Observatory 85
Innovations In Travel 85
Into The Wind/The Kite Source 87
JMB Inc 86
JSL Perpetual Technology Inc 84
Jackson Camera & Video 13
Jim's Photo Shack Inc 12
Jim's Mobile Industries 14
Johnson's Camera 13
Kalmbach Publishing ....25, 97, 101 ....104, 106
Kc Woodsmith 84
Khan Scope Center 99
Killgore Southwest 85
Lifelong Learning, Inc 91
L & T Instruments 99
Learning Technologies Inc 84
Let's Talk Worldwide Travel 86
Lumicon 42, 43
Mag One Instrument 85
Main Sequence 12
Makewood Products 86
Nick Marella 87
Marketplace, The 84, 85, 86, 87
McDonald Observatory 91
Meade Instruments ....2, 3, 7, 8, 9 .... 10, 11
Mountain Press Publishing 29
Mountain Skies Astronomical Society ... 84
Mr. Telescope 12
Murnaghan Instruments 16
New England Meteoritical 89
New Mexico Astronomical 87, 98
Newbridge Communications 19
Nova Optical Systems 86
Nurnberg Scientific 98
Obsession Telescope 87
Optical Guidence Sysems 99
Orion Telescope Center 54, 55
Outer Edge Expeditions 87
Pegasus Classifieds 87
Photo Researcher 87
Pocono Mountain Optics 20, 21 99
Precision Optics 25
Quantum Creations 16
Rainbow Symphony, Inc 87
Rivers Camera Shop 98
Santa Barbara Instrument Gr...23
Sarasota Camera Exchange Inc 98
Science Connection, Inc 86
Science Lab Software 87
Scientific Expeditions 96
Scope City 25
Shutan Camera & Video 14
Siber Optics 88
Sirius Instruments Co 91
Software Bisque 12
Software Systems Company 95
Spectra Astro-Systems 88
Star Gazer Instruments 99
Stargazer Steve 91
Starlight Planetarium Prod 86
The Starry Messenger 84
Starsplitter Telescopes 84
Stellar Vision 98
James A Stewart 87
Tech 2000 89
Technical Innovations 16
Tele Optics 98
Tele Vue Optics, Inc 113
Thousand Oaks Optical 93
Travel Star 87
Tuthill, Roger W. Inc 15, 93, 91
Unitron Inc 93
University Of Arizona 94
U.S. Space Foundation 27
Vista Instrument Co 92
Wholesale Optics (Pauli's) 31
Wilderness Travel 84
Wonder Works 99
Z Optical Shop 86
Zephyr Services 100

READER REPORTS

A Trek to the Southern Sky

Like many people who grew up in the Northern Hemisphere, Paul Gahlinger of Davis, California, found himself lured by the attractions of the southern sky. "The southern constellations are more beautiful and more intriguing in their mythological backgrounds than the northern ones," says Gahlinger, who reminds us that many of the southern star groups were assembled in the minds of 18th- and 19th-century astronomers. "The foremost author of southern star lore was the French astronomer Nicolas Louis de Lacaille," he says, "who compiled a catalog of more than 10,000 stars and named a good many southern constellations, including Mensa and Antlia."

Gahlinger is an epidemiologist at the University of California at Davis who found himself encountering the southern sky for the first time in a most extraordinary situation.

It was the autumn of 1992, and Gahlinger was hanging out in Windhoek, capital of the newly independent Namibia, with a couple of guys from Germany who were working for an international aid organization. They had 40 tons of dried food with them destined for famine relief in Angola, at the time mired in a civil war. Their mission complete, they eagerly accepted Gahlinger's invitation to accompany him on a bus trip to Cape Town, a thousand miles to the south.

The buses are luxurious, two-story roadliners that

The Magellanic Clouds over Las Campanas, Chile

by Alan Dyer
(28mm lens at f/2, Ektachrome 1600 film, 23-minute exposure taken at the 40-inch dome)

travel at night to escape the heat of the day," says Gahlinger. "They travel in pairs for security, and each bus tows a trailer of spare parts. The bus's route carried us along the western edge of the Kalahari Desert, separated by a mountain range from the even more desolate Namib Desert." One evening, a few hours down the road, the massive land yacht coasted to a stop. The 150-odd passengers spilled outside into the quiet night.

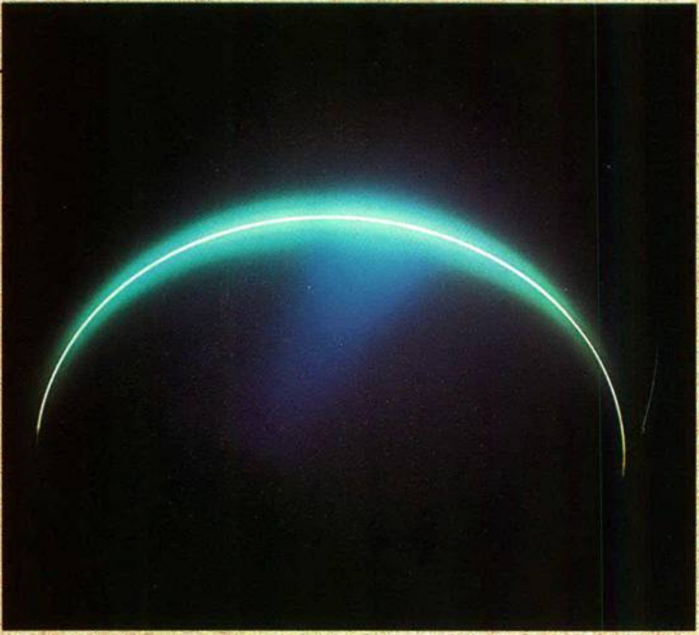
"I am moderately fluent in German and lost no time in beginning to point out the marvels that lay before us," says Gahlinger. Other travelers came over to Gallagher and his German friends and looked up — a British missionary couple, a Hottentot tribal family relocated to Windhoek, some Ovango men from the Botswana border region, some Xhosa and !Kung with their "melodious click languages," Gahlinger says, and others. "I began with Orion, but moved on to Centaurus, describing the nearest star to the Sun as it lay before us, and moved on through Crux and the glowing Milky Way," he says.

It was a beautiful, balmy night, and the stargazing continued as the bus was fixed. The distant lights brought everyone together. "The missionaries saw them as a testimonial to God's creation," says Gahlinger. "The Xhosa and !Kung talked in burbling murmurs. I thought, this is really why we study astronomy. And then the drivers finished, and we were on our way." ☐

ASTRONOMY wants to hear about your observations of the sky. Send reports, sketches, and photographs to David J. Eicher, Reader Reports Editor, ASTRONOMY, P.O. Box 1612, Waukesha, WI 53187. Please label each photo with name, address, and social security number. You may send written reports via the Internet to: 72000.2704@CompuServe. com

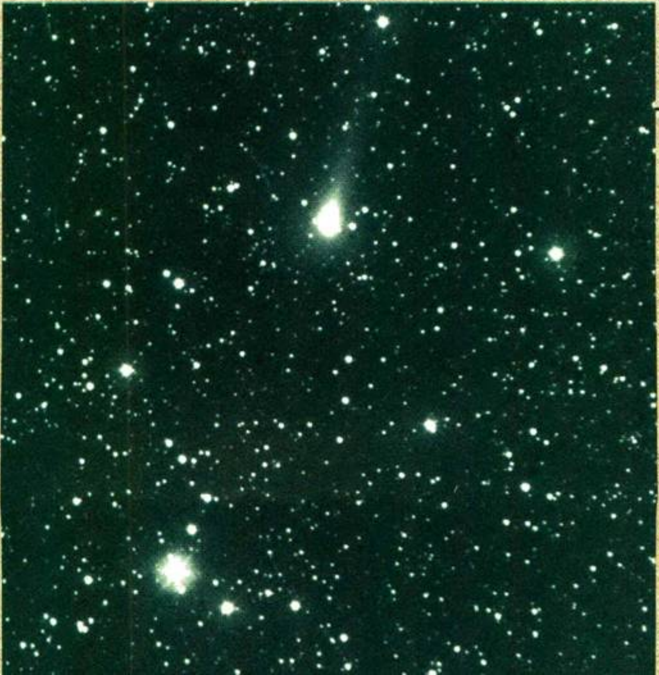
Nebulosity Surrounding Gamma Cygni

by George Greaney (6-inch f/7 refractor, Fuji Super HG 400 film, composite of two 60-minute exposures)



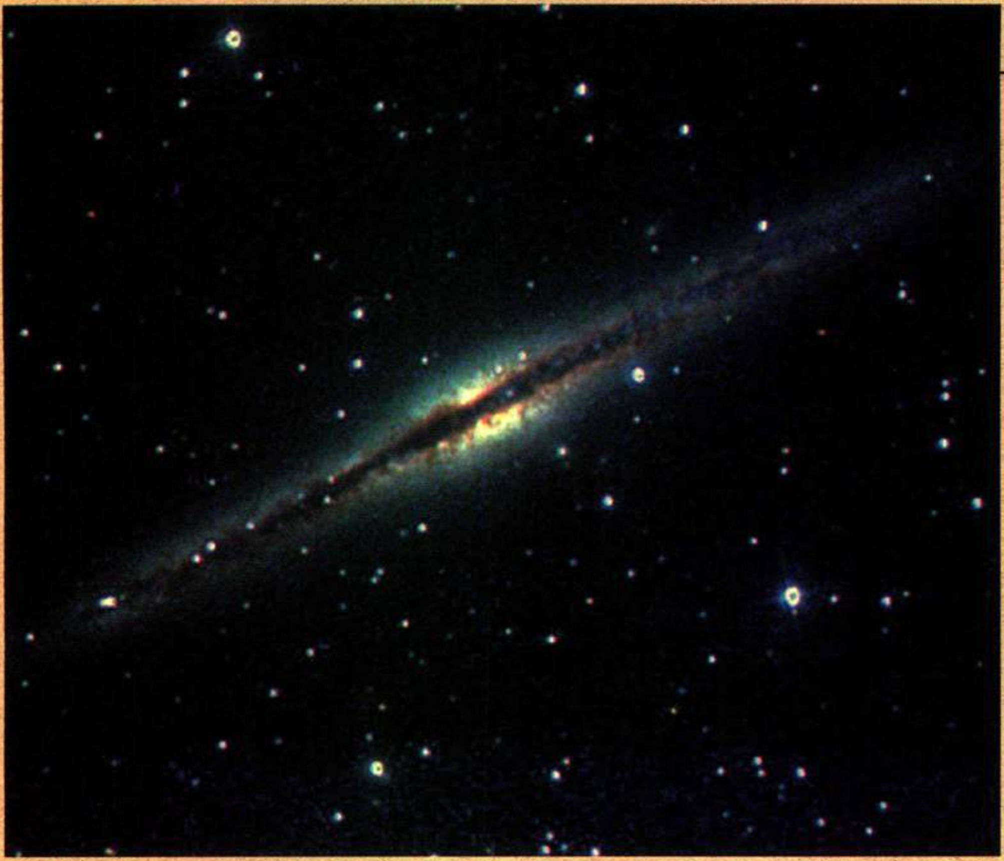
The Night Sky and the Sun's Path

by Karl Brandl (30mm f/3.5 fisheye lens, Fuji Velvia film, double exposure made on July 2, 1994 — a 60-minute exposure to record stars and a lengthy daytime exposure with a solar filter to record the Sun's path)



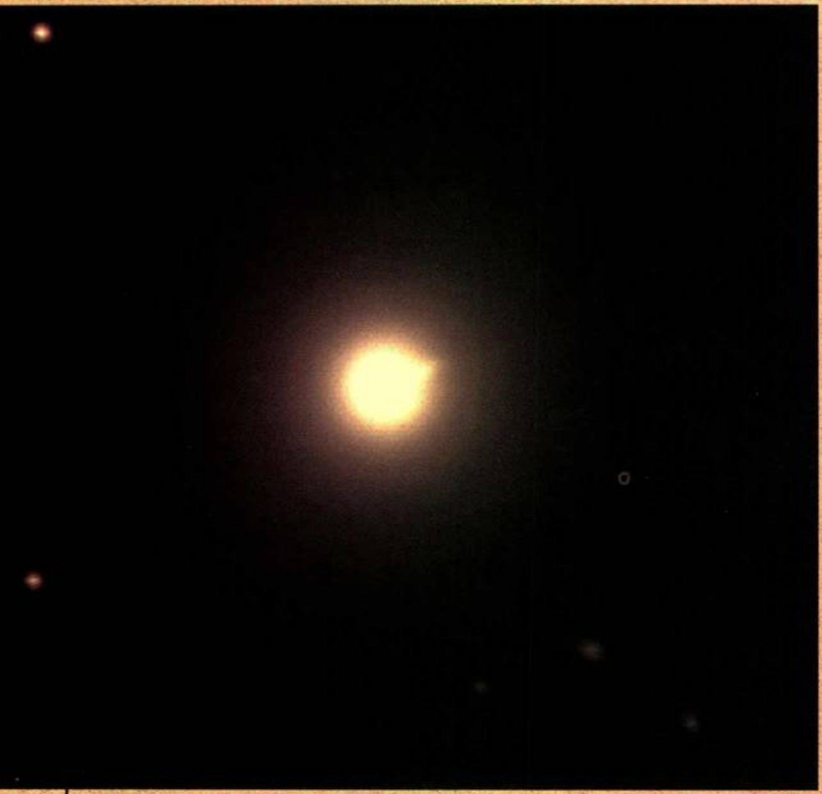
Periodic Comet Borrelly

by Gerald Rhemann (10-inch Schmidt camera, hypersensitized Tech Pan film, 7-minute exposure taken December 3, 1994)



Edge-on Galaxy NGC 891 in Andromeda

by Jack Newton
(25-inch f/5 reflector, ST-6 CCD camera)

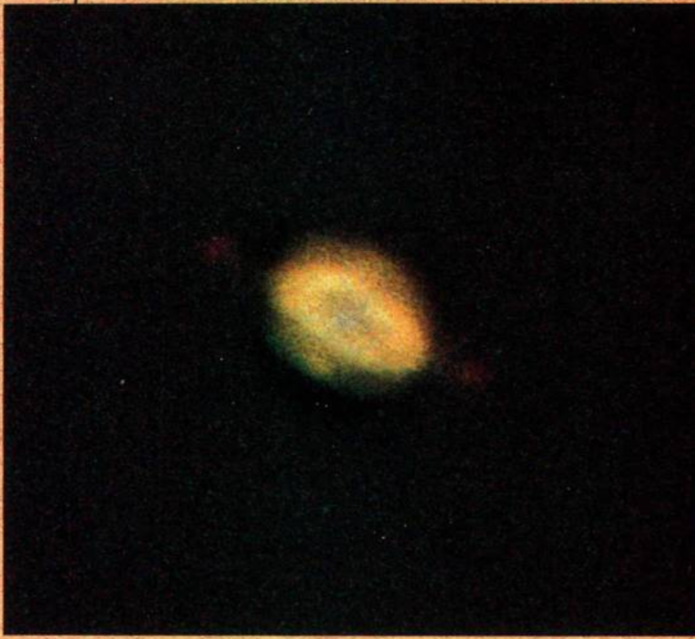


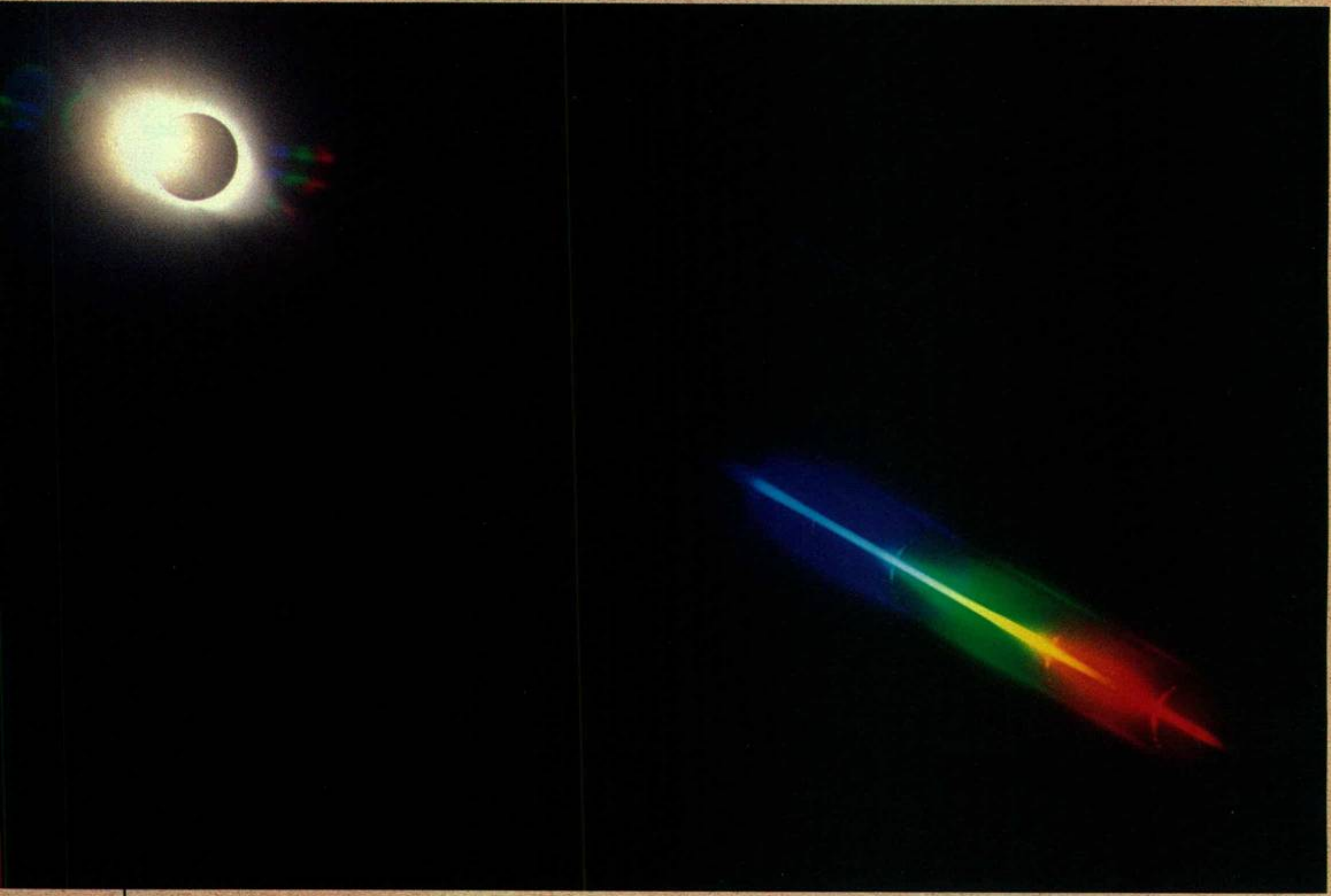
Giant Elliptical Galaxy M87 and Its Jet

by Stéphane Dumont
(9-inch f/12 SCT, ST-6 CCD camera, composite of ten 30-second exposures)

The Saturn Nebula in Aquarius

by Ken Blankenship and Dennis Batis
(14-inch f/11 SCT, hypersensitized Kodak Royal 400 film, 5-minute exposure using a Lumicon Skyfilter)



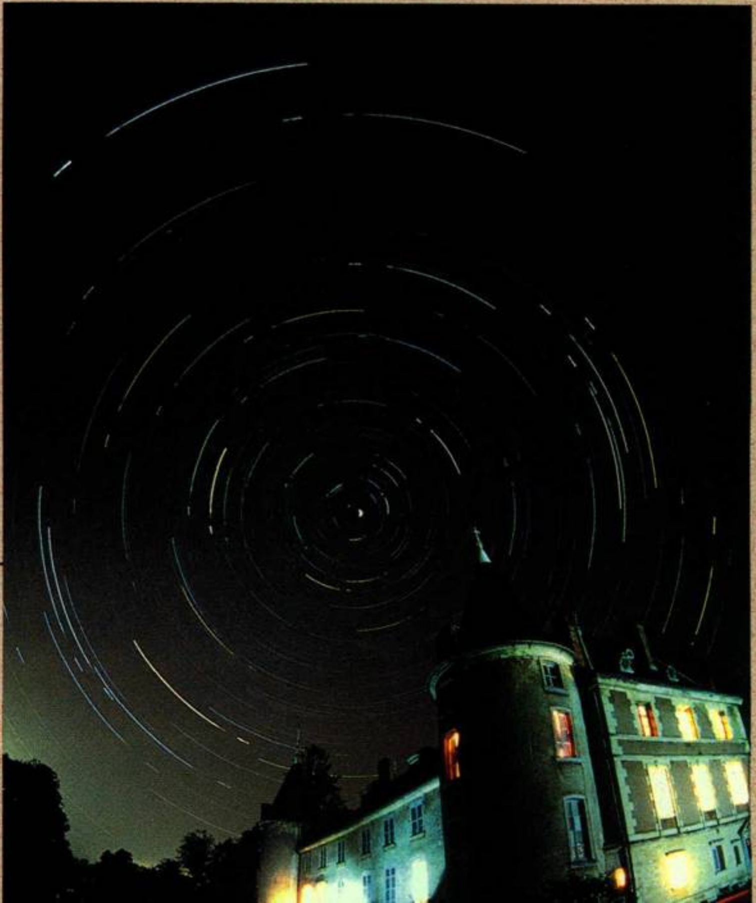


Flash Spectrum of the Solar Eclipse

by Robert B. Slobins/Phototake
(160mm lens at f/4, Fuji NHG 160 film pushed to ISO 640, shot with diffraction grating to produce a flash spectrum of the Sun, taken November 3, 1994)

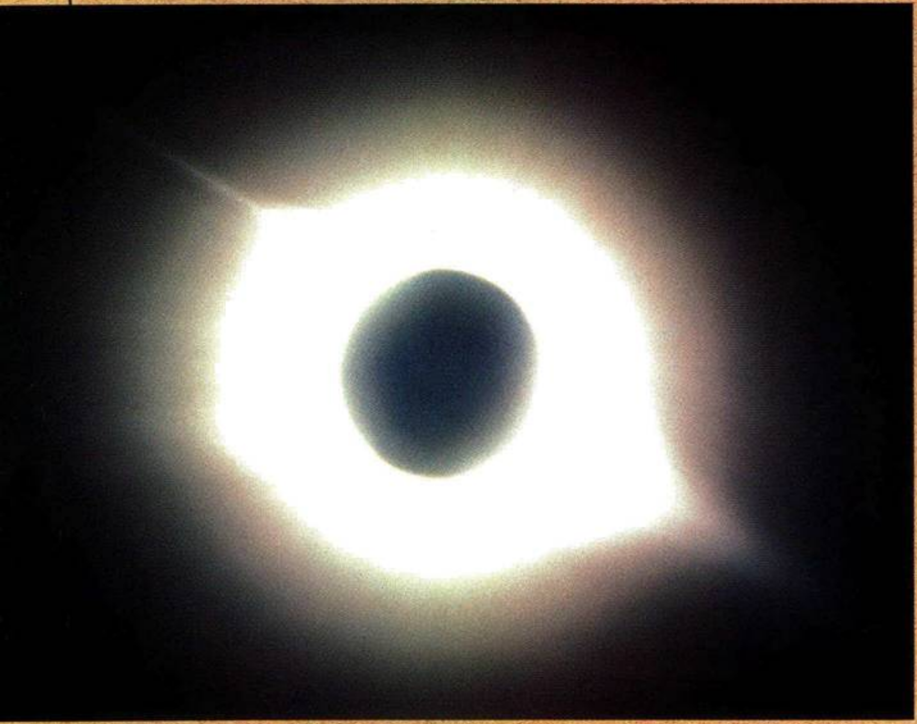
Circumpolar Star Trails Over Château de Nogent in France

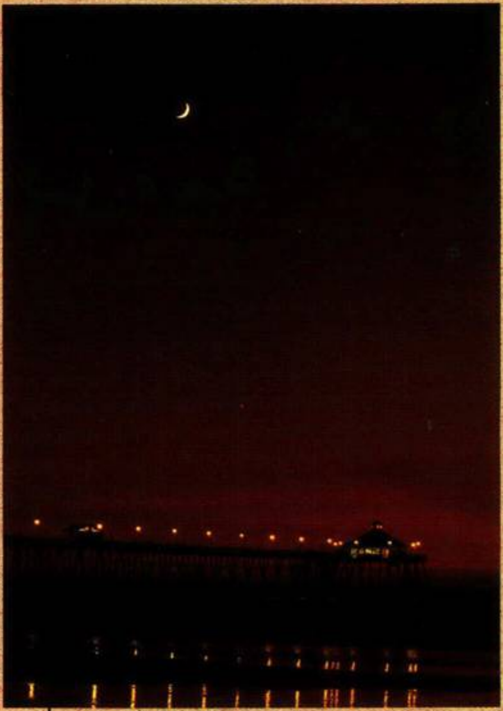
by Olivier de Goursac



Lunar Maria During November 3's Eclipse

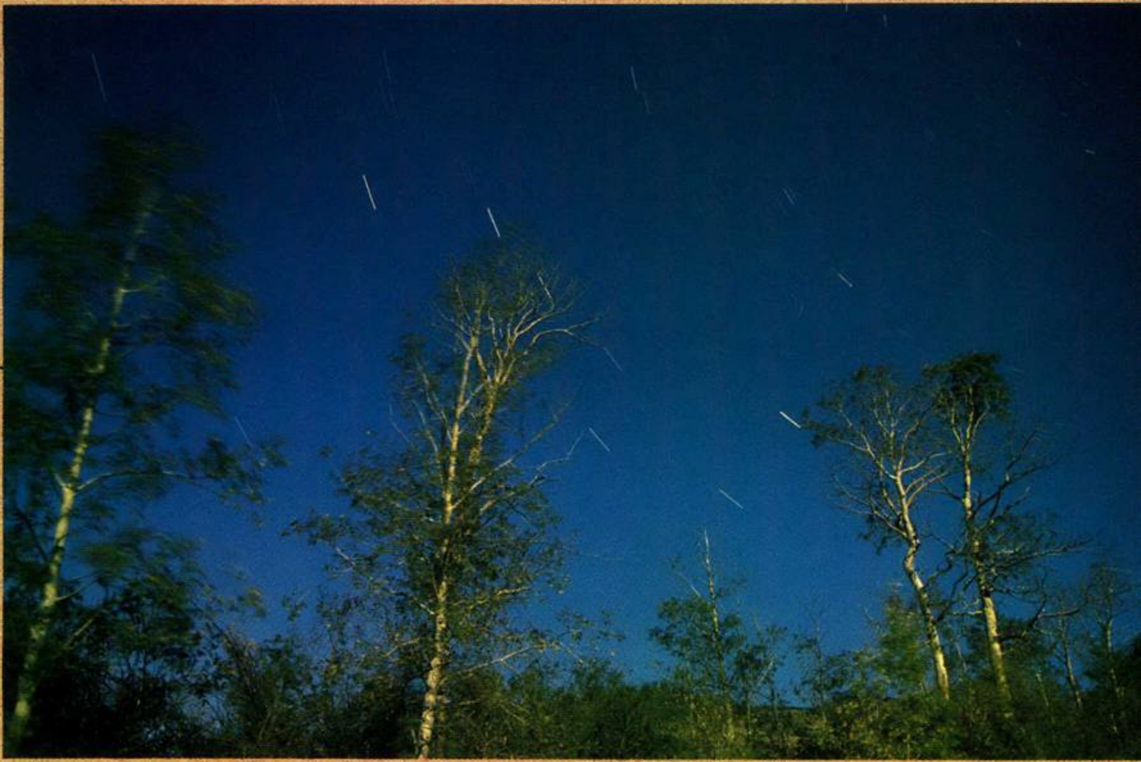
by Ronald E. Royer





The Moon Meets Jupiter and Venus

by Dennis L. Mammana (70mm lens at f/8, Fuji Velvia 50 film, 4-second exposure taken October 7, 1994)

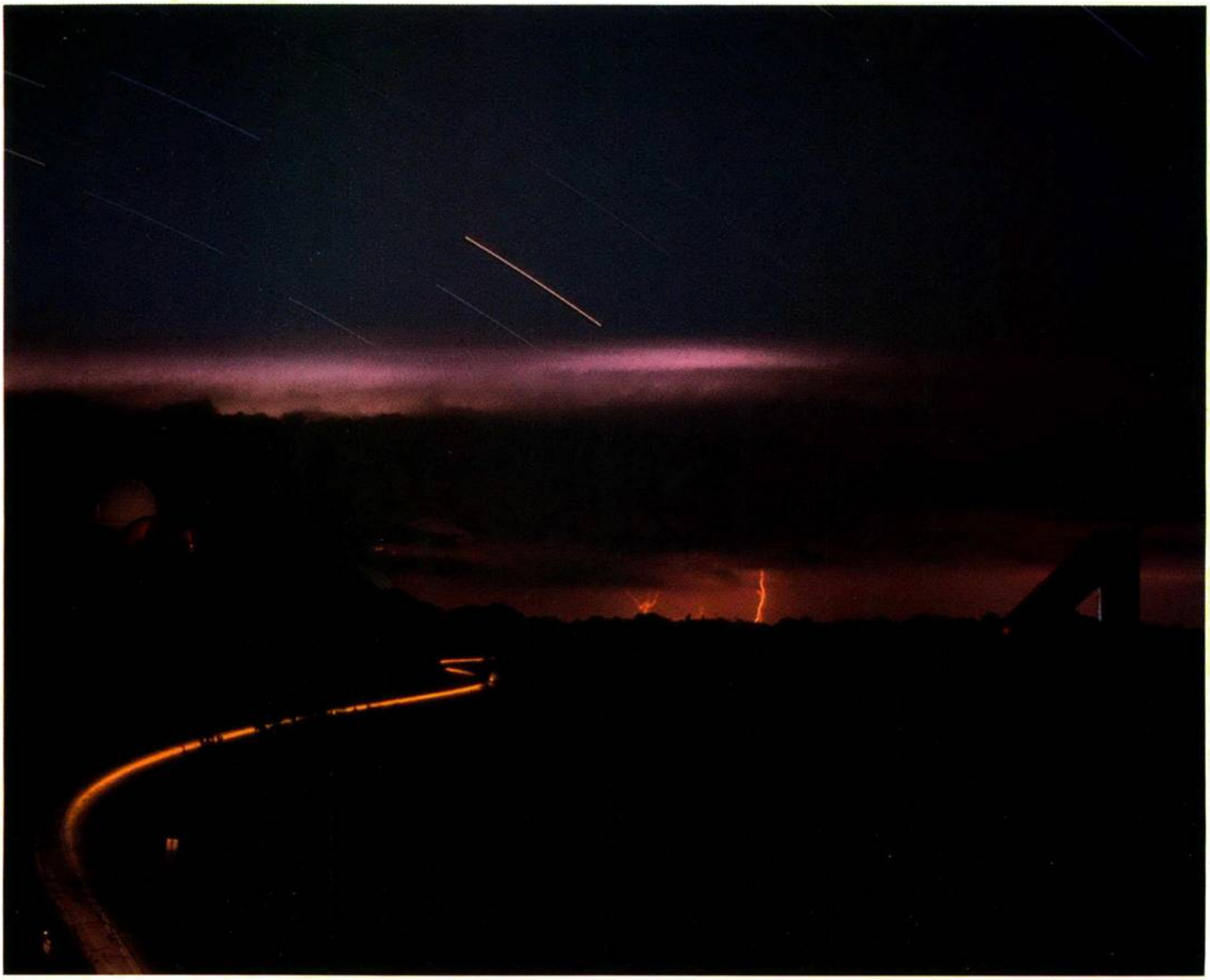


Big Dipper Wheels Above Moonlit Trees

by John McNeal (28mm lens at f/4, Fuji 100 film, 15-minute exposure taken September 17, 1994)

Ultimate Exposure

Wins $100 as ASTRONOMY's Best Astrophoto



Star Trails and Lightning on Kitt Peak

by Erich Karkoschka
(50mm lens at f/1.8, Agfa ISO 100 film, 20-minute exposure taken October 5, 1993)

"I took the shot during an observing run on the 2.3-meter telescope," says Karkoschka. "The bright star near the center is Ankaa [Alpha Phoenicis], and Beta Gruis lies near the righthand edge.

"Despite the nearby thunderstorm, I successfully recorded spectra of Saturn's moon Titan that yielded a rotation period of 15.95 days."

PRONTO

Pronto: 70mm Ap., 480mm F.L., f/6.8 E.D. doublet, 2" diagonal, 21mm Plössl, adapter, mount ring, shoulder bag all std.

1000+ The Amateur Astronomer's Field Guide to Deep Sky Observing
Pronto

The Little Scope That Could.

– from an unsolicited letter to Al Nagler

"My observations show that from a true-dark site, the telescope is a real performer. Large, low surface brightness objects are routinely visible; even I was surprised by the visibility of NGC 147. Using the stars plotted on Uranometria, I traced the Andromeda galaxy to 4° length on two nights." — Brian Skiff, Author & Astronomer

— *Requirements: simple enough to learn on and teach my kids; good enough so that I won't keep wondering if I should have bought something "better;" super portable. No picture or description prepared me for the beauty of the design or the excellence of the workmanship.* J.T. - RI

— *It is of the usual Tele Vue perfection.* S.B. - PA

— *I have a 10" Newtonian and wanted a little scope for quick looks at the sky and daytime nature study. What a beautiful, perfect little instrument! The detail it shows on Jupiter is absolutely unbelievable.* B.D. - CO

— *Well done! Saw the Owl and M108 in same field.* T.J. - KS

— *I was able to see Jovian lunar shadow transit easily with this instrument. I love the design and features - I may have to buy a Genesis!* R.G. - PA

— *It's almost as if I'm not using a scope at all. Too many scopes just get in the way and make observing a frustrating experience.* T.Z. - NY

Pronto photo of Eta Carina by Ralph Sieger

Tele Vue®

Send for full-line literature, please include $3 for postage & handling
Tele Vue Optics, 100A Route 59, Suffern, NY 10901. (914) 357-9522

Total Solar Eclipse Cruise
Call Global 9 Cruises
1 800 770-AWAY (2929)

15 day cruise/tour Bangkok, Singapore, Malaysia, Vietnam, Borneo on Orient Lines Marco Polo, includes 3 hotel nights in Bangkok, 2 in Singapore, Entertainment, Cocktail Parties, Excursions, Transfers included. Oct 12-28 1995, as low as $3,195 plus low cost air.

THE CELESTRON C5's

The 5" f/10 Schmidt-Cassegrain telescope is a serious, high quality precision instrument made in the U.S.A. For astronomy on the go, the C5 can't be beat. Being extremely portable, it fits virtually anywhere from a compact car trunk to most airline overhead compartments. The C5 is versatile and highly expandable with numerous optional accessories. There are actually two models of the C5 – one is an AC unit (C5) and the other a DC unit (C5⁺). Otherwise, the two models are identical.

SUPERB OPTICS

Astronomy Magazine in a recent review said, "The C5 I tested contained superb optics. At high powers, stars exhibited a clearly defined Airy disk surrounded by a bright first diffraction ring and several successively fainter outer rings. This was a telescope that demonstrated how well Schmidt-Cassegrain optics can perform and met **Celestron's** promise of diffraction-limited optics."

In a recent review by *Sky & Telescope*, the following is noted, "the optical correction and factory collimation were excellent. At high magnification, bright stars were surrounded by a classic set of diffraction rings."

The C5 is truly a multipurpose instrument – an astronomical telescope, a spotting scope and a 1250mm f/10 telephoto lens. Great for terrestrial applications such as bird watching, nature study, vistas from view homes or as a superb 1250mm telephoto lens. It even focuses as close as 20'.

The C5 features Starbright® multi-coatings. Standard accessories include a 5x24 Finderscope, Star Diagonal – 1¼", Visual Back – 1¼", 25mm SMA Eyepiece – 1¼" and the equatorial wedge. Weight is 23 lbs. (including wedge).

C5⁺

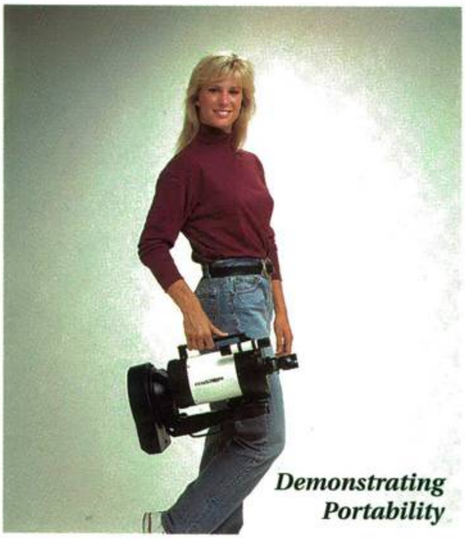
ACCURATE DRIVES

The C5 with the AC drive system is all that is needed for observational use, especially near AC power sources.

The larger light gathering power of the C5 over smaller telescopes allows observation of amazing lunar details, plus high power viewing of the planets to see detail in Jupiter's equatorial belts, the fascinating ring structure of Saturn as well as the polar caps of Mars. The C5 is large enough to observe hundreds of deep-sky objects, fully resolve many globular star clusters, and allow you to enjoy brighter nebulae, double stars and brighter galaxies.

The electronics of the C5⁺ have a built-in drive controller with hand control and is powered by a single 9 volt alkaline battery and runs for 50 hours!

The C5⁺ is the ideal choice for astrophotography. As *Astronomy Magazine* said, "With its combination of fine optics, smooth drive system, and built-in drive corrector, the C5⁺ proved to be a good telescope for all kinds of astrophotography."



Demonstrating Portability

• FREE OFFER •

Value over $100.00

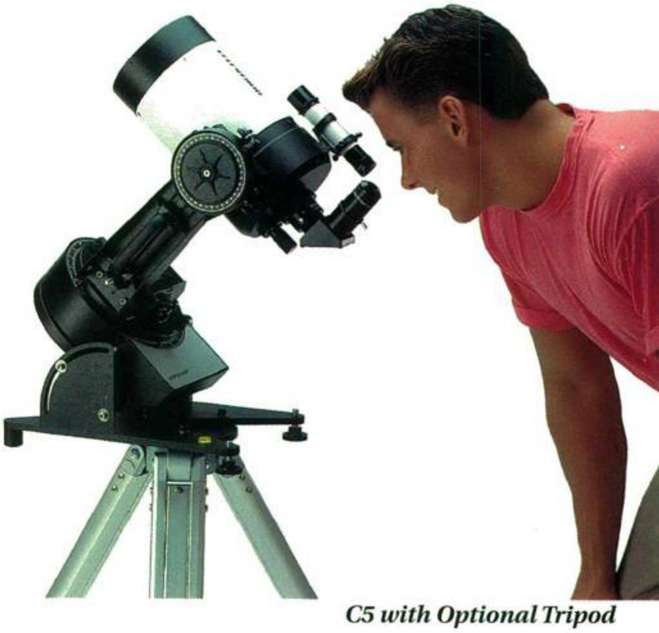
Purchase either of these telescopes between March 1, 1995 and May 31, 1995 and you can receive ***free:***

10mm SMA Eyepiece – 1¼", LED Flashlight and Celestron Sky Maps.

To receive your ***free*** accessories in the U.S.A., send proof of purchase to the Celestron Customer Service Department.

The C5 easily converts to a computerized telescope with the optional Advanced Astro Master® (AAM) This pointing system contains a data base of over 10,000 objects. The AAM operates from a single 9 volt alkaline battery for over 30 hours. It contains an RS-232 series interface.

The computer assisted telescope is fun and makes it easy to enjoy our Universe. You can find hundreds or thousands of objects easily.



C5 with Optional Tripod

For more detailed information on these telescopes, contact your Celestron dealer or Celestron.

CELESTRON® LIGHT YEARS AHEAD OF THE COMPETITION

Celestron International • 2835 Columbia Street, Torrance, CA 90503 • (310) 328-9560 • FAX (310) 212-5835